



Missouri Department of Natural Resources

Biological Assessment Report

Millers Creek Callaway County

March 2002 – April 2003

Prepared for:

Missouri Department of Natural Resources
Water Protection and Soil Conservation Division
Water Protection Program

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1.0 Introduction

At the request of the Water Protection Program (**WPP**), the Environmental Services Program's (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of Millers Creek, which flows through a rural watershed in western Callaway County, Missouri. Millers Creek also flows through Mertens' Quarry where WPP staff noted observable quantities of varying sizes of limestone deposited in the creek downstream of the road crossing on the quarry property.

Sample stations from five other streams in Callaway County were used as controls to compare with two sampling stations on Millers Creek. These comparisons were used to determine whether biological impairment exists in a stream receiving limestone quarry runoff. The five other streams sampled were Bachelor Creek, Middle River, Whetstone Creek, Prairie Fork, and Hillers Creek. Local controls were necessary because Millers Creek is in a transitional area between Ozark and Prairie and regional reference streams may not be appropriate depending on soil and geological conditions. Additional local controls are also necessary because Millers Creek is not a perennial stream, therefore biological criteria for wadeable/perennial streams may not apply.

Because Millers Creek is not perennial, sampling was only conducted during the spring biomonitoring sample season. Sampling at Millers Creek and the five control streams was conducted on March 26-April 2, 2002 and April 2-10, 2003. Sampling was conducted by Brian Nodine, Sam McCord, and Carl Wakefield of the Environmental Services Program, Air and Land Protection Division.

On February 14, 2002 a study plan was submitted to the WPP (Appendix A). Two null hypotheses were stated in this plan. The first was that macroinvertebrate assemblages would not differ between the two longitudinally separate reaches of Millers Creek. The second was that macroinvertebrate assemblages would not differ between Millers Creek and similar sized reaches of the other five control streams.

2.0 Study Area

Millers Creek originates in western Callaway County just northeast of Millersburg and flows south southwest through its upper watershed of rural pasture land and wooded areas (Table 1) until its confluence with Cedar Creek at the Callaway/Boone County line. According to Title 10. Rules of Department of Natural Resources Division 20-Clean Water Commission, Chapter 7-Water Quality. 10 CSR 20-7.031 Water Quality Standards, the 1.5-mile section upstream from the mouth is designated class "C" with beneficial use designations of "livestock and wildlife watering" and "warm water aquatic life protection".

All five local control stream sample stations are also designated class "C" with beneficial use designations of "livestock and wildlife watering" and "warm water aquatic life protection". These streams were chosen as controls because of their proximity to the

study stream within the same EDU, watersheds of comparable size, and relative lack of impairment sources.

Millers Creek and the five control streams are located within the Ozark/Moreau/Loutre (O/M/L) EDU. An EDU is a region in which biological communities and habitat conditions can be expected to be similar. Please see Appendix B for maps of the EDUs and the 14-digit Hydrologic Units (HU) that contain the sampling reaches for Millers Creek and the five reference streams. See Table 1 for a comparison of land use for the EDU and the 14-digit HUs. Land cover data were derived from the Thematic Mapper satellite data from 1991-1993 and were interpreted by the Missouri Resource Assessment Partnership (MoRAP).

Table 1
Percent Land Cover

	14-digit HU	Urban	Cropland	Grassland	Forest	Swamp
O/M/L* EDU		1.9	20.9	40.3	35	0
Millers Cr.	10300102190002	0	12.8	46.4	39.2	0
Bachelor Cr.	10300200030001	0	41.3	31.8	25.9	0
Middle R.	10300102240001	0	9.3	46	43.2	0
Whetstone Cr.	10300200030003	0	38.3	25.4	35.5	0
Prairie Fork	10300200030005	0	17.8	20.9	60.6	0
Hillers Cr.	10300102240002	0.1	14	45	40.2	0

* Ozark/Moreau/Loutre

3.0 Site Descriptions

All sampling locations were located within Callaway County. The average width and discharge measurements during both survey periods are given for each sampling station in Table 2 of the results section. All stations are within class "C" segments.

Millers Creek Station #1 (SW ¼ sec. 14, T. 47 N., R. 11 W.) was located approximately ¾ mile downstream of the most downstream crossing at Mertens' Quarry. Geographic coordinates at the upstream terminus of this station were Lat. 38° 50' 56.8" N, Long. 92° 07' 27.4" W.

Millers Creek Station #2 (NE ¼ sec. 14, T. 47 N., R. 11 W.) was located immediately downstream of the most downstream crossing at Mertens' Quarry. Geographic coordinates at the upstream terminus of this station were Lat. 38° 51' 17.1" N, Long. 92° 07' 18.8" W.

Bachelor Creek Station #1 (NW ¼ sec. 34, T. 49 N., R. 7 W.) was located just west of the southern terminus of County Road 1037. Geographic coordinates at the downstream terminus of this station were. Lat. 38° 58' 52.6" N, Long. 91° 41' 39.5" W.

Middle River Station #1 (NE ¼ sec. 5, T. 45 N., R. 9 W.) was just downstream of the County Road 305 bridge. Geographic coordinates at the upstream terminus were Lat. 38° 42' 18.9" N, Long. 91° 57' 28.8" W.

Whetstone Creek Station #1 (NW ¼ sec. 10, T. 48 N., R. 7 W.) was just upstream of the County Road 1005 bridge at the Missouri Department of Conservation's (MDC) Whetstone Creek Conservation Area. Geographic coordinates at the downstream terminus were Lat. 38° 57' 09.7" N, Long. 91° 41' 24.4" W.

Prairie Fork Station #1 (NE ¼ sec. 11, T. 47 N., R. 7 W.) was just upstream of the County Road 170 bridge. Geographic coordinates at the downstream terminus were Lat. 38° 51' 51.4" N, Long. 91° 39' 52.5" W.

Hillers Creek Station #1 (SE ¼ sec. 33, T. 46 N., R. 10 W.) was just upstream of County Road 436. Geographic coordinates at the downstream terminus were Lat. 38° 43' 03.2" N, Long. 92° 02' 38.2" W.

4.0 Methods

4.1 Macroinvertebrate Collection and Analysis

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP) (MDNR 2003a). Three standard habitats, flowing water over coarse substrate (**CS**), depositional substrate in non-flowing water (**NF**), and rootmat (**RM**) at the stream edge were sampled at all locations.

A standardized sample analysis procedure was followed as described in the SMSBPP. The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**).

Macroinvertebrate data were analyzed in three specific ways. First, a longitudinal comparison between two Millers Creek reaches, one located immediately below the crossing at Mertens' Quarry and the other approximately ¾ mile downstream of the quarry crossing, was performed. Second, Millers Creek stations were compared to the five local control stations. Finally, the data from both Millers Creek and five local control streams were compared to biological criteria from regional reference streams within the same EDU. Biocriteria data collected from previous survey years constituted the basis of the comparison with regional control streams.

4.2 Physicochemical Data Collection and Analysis

During each survey period, *in situ* water quality measurements of temperature (°C), dissolved oxygen concentration (mg/L), conductivity (µS/cm), and pH were collected at

all stations. Standard Operating Procedures were followed for Field Measurement of Water Temperature (MDNR 1993), Sample Collection and Field Analysis for Dissolved Oxygen Using a Membrane Electrode Meter (MDNR 2002b), Field Analysis for Specific Conductance (MDNR 2000a), and Field Analysis of Water Samples for pH (MDNR 2001a), respectively. Additionally, water samples were collected and analyzed by ESP's Chemical Analysis Section for turbidity (NTU), chloride, total phosphorus, ammonia-N, nitrate + nitrite-N, and total Kjeldahl nitrogen (TKN).

Stream velocity was measured at each station during each survey period using a Marsh-McBirney Flo-Mate Model 2000. Discharge was calculated per the methods in the Standard Operating Procedure Flow Measurement in Open Channels (MDNR 2001b).

Stream habitat characteristics for each sampling station were measured during the 2003 survey period using a standardized assessment analysis procedure as described for riffle/pool habitat in the Stream Habitat Assessment Project Procedure (MDNR 2003b).

Physicochemical data were summarized and presented in tabular form for comparison among the two stations on Millers Creek and between Millers Creek stations and those of the five local control streams.

4.3 Quality Assurance/Quality Control (QA/QC)

QA/QC procedures were followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a).

5.0 Data Results

5.1 Physicochemical Data

Physical characteristics of each Millers Creek station and the five control stations are presented in Table 2. Average stream widths at Millers Creek stations ranged from 36 to 39 feet and ranged from 30 to 74 feet in the five control streams.

Table 2
Physical Characteristics of the Stations

Stream/Station		Spring 2002	Spring 2003
	Ave. Width (feet)	Flow (cfs)	Flow (cfs)
Millers Cr. #1	36	2.4	3.78
Millers Cr. #2	39	1.2	3.53
Bachelor Cr.	30	12	4.38
Middle R.	74	21.5	9.36
Whetstone Cr.	60.6	25.8	7.58
Prairie Fork	65.4	7.91	5.59
Hillers Cr.	59.2	8.87	3.31

In situ water quality measurements are summarized in Table 3 (spring 2002) and Table 4 (spring 2003). Mean temperatures at Millers Creek stations were 11°C and 8.8°C in the 2002 and 2003 surveys, respectively. During the 2002 survey, temperatures in the five control sites ranged from 5°C at Prairie Fork to 10°C at Middle River with a mean value of 8°C. During the 2003 survey, temperatures at the five control sites ranged from 6.5°C at Whetstone Creek to 18.5°C at Hillers Creek with a mean value of 13°C.

Conductivity levels were notably higher at Millers Creek during the 2002 survey, but comparable to levels with Middle River and Whetstone Creek during the 2003 survey. Dissolved oxygen levels were fairly consistent and ranged from 9.5 mg/L to 13.7 mg/L during both surveys with the exception of Hillers Creek at 7.3 mg/L during the 2003 survey.

Table 3
In situ Water Quality Measurements at all Stations (Spring 2002)

Stream/Station	Parameter				
	Temp. (°C)	Diss. O ₂ (mg/L)	Cond. (µmhos/cm)	pH	Turb. (NTU)
Millers Cr. #1	10	10.9	716	8.3	5.5
Millers Cr. #2	12	10.6	647	8.2	5.4
Bachelor Cr.	9	11.2	206	8	35.3
Middle R.	10	11.5	424	8.6	5.47
Whetstone Cr.	9	11	255	7.8	44.6
Prairie Fork	5	13.7	221	8.6	23.6
Hillers Cr.	8	12.5	341	8.6	19.6

Table 4
In situ Water Quality Measurements at all Stations (Spring 2003)

Stream/Station	Parameter				
	Temp. (°C)	Diss. O ₂ (mg/L)	Cond. (µmhos/cm)	pH	Turb. (NTU)
Millers Cr. #1	11	11.5	465	8	18
Millers Cr. #2	6.5	9.5	479	7.6	22.6
Bachelor Cr.	9	11.1	231	7.9	23
Middle R.	15	9.8	435	7.8	5
Whetstone Cr.	6.5	9.5	479	7.7	23.7
Prairie Fork	17.5	11.3	292	8.8	2.2
Hillers Cr.	18.5	7.3	343	8.7	6.2

Nutrient concentrations as well as chloride concentrations are presented in Table 5 (spring 2002) and Table 6 (spring 2003). Ammonia and total phosphorus concentrations were near or below the detection limit of 0.05 mg/L at all stations during both survey periods. With the exception of Millers Creek #2, nitrate + nitrite levels were generally higher during the 2002 survey than the 2003 survey, especially at Whetstone Creek and Millers Creek #1. Millers Creek nitrate + nitrite levels during the 2003 survey were slightly higher than levels from the five control streams. Chloride and TKN concentrations for Millers Creek are consistent with levels in the five control streams and at all stations during both survey periods; chloride levels were well below chronic criteria for protection of aquatic life and drinking water supply.

Table 5
 Nutrient Concentrations at all Stations (Spring 2002)

Stream/Station	Parameter (mg/L)				
	NH ₃ -N	NO ₃ + NO ₂ -N	TKN	Total Phos.	Chloride
Millers Cr. #1	<0.05	0.52	0.33	<0.05	21.6
Millers Cr. #2	<0.05	0.13	0.5	0.05	14.3
Bachelor Cr.	<0.05	0.19	0.78	0.08	13.1
Middle R.	<0.05	0.05	0.28	<0.05	11.6
Whetstone Cr. (1A)	<0.05	0.97	1.02	0.14	22.2
Whetstone Cr. (1B)	<0.05	0.97	1.13	0.15	22
Prairie Fork	<0.05	0.17	0.56	0.08	5.34
Hillers Cr.	<0.05	0.18	0.63	0.09	18.8

Table 6
 Nutrient Concentrations at all Stations (Spring 2003)

Stream/Station	Parameter (mg/L)				
	NH ₃ -N	NO ₃ + NO ₂ -N	TKN	Total Phos.	Chloride
Millers Cr. #1	<0.05	0.22	0.76	0.15	11
Millers Cr. #2	0.07	0.26	0.62	0.14	10.9
Bachelor Cr.	<0.05	<0.05	0.65	0.1	10.4
Middle R.	<0.05	<0.05	0.56	0.09	11.3
Whetstone Cr.	<0.05	0.08	0.65	0.1	16.8
Prairie Fork	<0.05	0.12	0.34	0.05	6.39
Hillers Cr.	<0.05	<0.05	0.43	0.08	15.8

5.2 Habitat Assessment

Habitat assessment scores were recorded for each sampling station. Results are presented in Table 7. According to the project procedure, for a study site to fully support a biological community, the total score from the physical habitat assessment should be 75% to 100% similar to the total score of the control site. The mean habitat score for the

five control sites was 141. Both Millers Creek stations had habitat scores that exceeded or were well within the aforementioned range of similarity. It was therefore inferred that based on habitat, the sites should support comparable biological communities.

Table 7
 Control Streams and Millers Creek Habitat Scores (2003)

Control Stream	Habitat Score	Millers Creek	Habitat Score	% of Mean Control
Bachelor Cr.	147	Station #1	152	108
Middle R.	132	Station #2	129	91
Whetstone Cr.	139			
Prairie Fork	142			
Hillers Cr.	145			
Mean Control Score	141			

5.3 Biological Assessment

5.3.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)

The SMSBPP evaluation used biological criteria that were calculated from two sources as explained in Biological Criteria for Wadeable/Perennial Streams of Missouri (MDNR 2002a). The first source was ESP's database of Biological Criteria for Wadeable and Perennial Streams within the Ozark/Moreau/Loutre EDU spring season and these criteria are listed in Table 8. The second source was the five local control streams and the bioassessment criteria are listed in Table 9. The Stream Condition Index (SCI) for the five control streams was derived from Ozark/Moreau/Loutre EDU spring season criteria. Stream Condition Index sustainability scores of 20-16 qualify as fully sustaining, 14-10 is partially sustaining, and 8-4 is considered non-sustaining of aquatic life.

Table 8
 Biological Criteria for Warm Water Reference Streams Database in the
 Ozark/Moreau/Loutre EDU Spring Season

	Score = 5	Score = 3	Score = 1
TR	>71	71-36	35-0
EPTT	>13	13-6	5-0
SI	>2.8	2.8-1.4	1.39-0
BI	<6.45	6.45-8.22	8.23-10

Table 9
 Bioassessment Criteria for Local Control Streams

	Score = 5	Score = 3	Score =1
TR	>75	75-38	37-0
EPTT	>16	16-8	7-0
SI	>2.6	2.6-1.3	1.29-0
BI	<6.63	6.63-8.32	8.33-10

5.3.2 Comparisons of Millers Creek Between Criteria Derived From the Five Local Control Streams versus Ozark/Moreau/Loutre EDU Biocriteria

Stream Condition Indices were calculated for Millers Creek and compared between those derived from Ozark/Moreau/Loutre EDU biocriteria references versus those derived from bioassessment criteria of the five control streams. This comparison was made to assess the degree to which using biological criteria was applicable for Millers Creek. Millers Creek typically is intermittent during the fall sampling season, however has steady flow during the spring while biocriteria reference streams have permanent flow. Therefore, streams of similar size and flow regimes were used for comparison. The four metrics and SCIs for Millers Creek during 2002 and 2003 are presented in Tables 10 and 11, respectively. During both 2002 and 2003 sample seasons, both Millers Creek sites received identical SCI rankings within a season whether derived from the five local control streams or the Ozark/Moreau/Loutre EDU.

Table 10
 Metric Values and Stream Condition Indices for Millers Creek
 Spring 2002 Sampling Season

Using Ozark/Moreau/Loutre Biocriteria Reference Database						
Site	TR	EPTT	SDI	BI	T-Score	Sustain.
#1 Value	67	15	2.3	7.05		
#1 Score	3	5	3	3	14	Partial
#2 Value	50	14	1.47	6.69		
#2 Score	3	5	3	3	14	Partial
Using Five Control Streams						
#1 Score	3	3	3	3	12	Partial
#2 Score	3	3	3	3	12	Partial

Table 11
 Metric Values and Stream Condition Indices for Millers Creek
 Spring 2003 Sampling Season

Using Ozark/Moreau/Loutre Biocriteria Reference Database						
Site	TR	EPTT	SDI	BI	T-Score	Sustain.
#1 Value	78	16	2.72	7.00		
#1 Score	5	3	5	3	16	Full
#2 Value	79	12	2.87	6.68		
#2 Score	5	5	3	3	16	Full
Using Five Control Streams						
#1 Score	5	3	5	3	16	Full
#2 Score	5	3	5	3	16	Full

5.3.3 Millers Creek Longitudinal Comparison

The Millers Creek site at the quarry, immediately downstream from the crossing (Station 2), was compared with the site approximately ¾ mile downstream (Station 1). There are no substantial differences in metrics to change the SCI scores and rankings between the two Millers Creek sites within sampling seasons. Both sites' SCI rankings were "partially sustainable" during the 2002 season (Table 10). Total SCI scores and rankings were higher for both Millers Creek sites during the 2003 sampling season. During the 2003 sampling season, both Millers Creek sites received a "fully sustainable" SCI ranking with a total score of 16 (Table 11). Some trends in metrics were found between Miller Creek stations during the 2003 and 2002 seasons. During the spring 2003 sampling season EPTT were 16 at station #1 and 12 at station #2. During the spring 2002 sampling season Taxa Richness was 67 at station #1 and only 50 at station #2. Both of these differences indicate some degree of downstream improvement.

5.3.4 Comparison of Millers Creek versus Local Control Streams

During the 2002 sampling season, Bachelor Creek and Whetstone Creek had SCI rankings of "fully sustainable" while the other three control streams received a "partially sustainable" SCI ranking using Ozark/Moreau/Loutre EDU biocriteria for spring sampling (Table 12). By comparison, both Millers Creek stations in 2002 had SCI rankings of "partial".

All five control streams received SCI rankings of "fully sustainable" during the 2003 sampling season (Table 13) which is comparable to the SCI rankings for both Millers Creek sites during the same season.

Table 12
 Metric Values and Stream Condition Indices for the Five Control Streams for 2002,
 Using Ozark/Moreau/Loutre Biocriteria Reference Database

Site	TR	EPTT	SDI	BI	T-Score	Sustain.
Bachelor Cr. Value	79	15	2.82	6.60		
Bachelor Cr. Score	5	5	5	3	18	Full
Middle R. Value	71	16	2.52	6.65		
Middle R. Score	3	5	3	3	14	Partial
Whetstone Cr. (1A) Value	86	18	2.80	6.57		
Whetstone Cr. (1A) Score	5	5	3	3	16	Full
Whetstone Cr. (1B) Value	78	16	2.87	6.68		
Whetstone Cr. (1B) Score	5	5	5	3	18	Full
Prairie Fork Value	66	14	2.19	6.45		
Prairie Fork Score	3	5	3	3	14	Partial
Hillers Cr. Value	64	16	2.26	7.16		
Hillers Cr. Score	3	5	3	3	14	Partial

Table 13
 Metric Values and Stream Condition Indices for the Five Control Streams for 2003,
 Using Ozark/Moreau/Loutre Biocriteria Reference Database

Site	TR	EPTT	SDI	BI	T-Score	Sustain.
Bachelor Cr. Value	80	16	2.98	6.38		
Bachelor Cr. Score	5	5	5	5	20	Full
Middle R. Value	88	22	6.19	3.65		
Middle R. Score	5	5	5	5	20	Full
Whetstone Cr. Value	81	15	3.28	6.53		
Whetstone Cr. Score	5	5	5	3	18	Full
Prairie Fork Value	80	16	2.73	6.42		
Prairie Fork Score	5	5	3	5	18	Full
Hillers Cr. Value	93	23	3.43	6.42		
Hillers Cr. Score	5	5	5	5	20	Full

5.3.5 Macroinvertebrate Percent and Community Composition

The number of macroinvertebrate taxa richness, EPT taxa, and percent EPT are presented in Tables 14 and 15. These tables also present percent composition for the five dominant macroinvertebrate taxa at both Millers Creek sites and the five local control streams. The percent relative abundance data were averaged from the sum of the three macroinvertebrate habitats (coarse substrate, non-flow, and rootmat) sampled at each station.

At both Millers Creek stations and all five local control streams during both sampling seasons, Diptera was the dominant order and Chironomidae was the dominant family. Canedidae was also well represented at both Millers Creek sites during both seasons as well as most of the five control streams, especially during the 2002 season. Millers Creek station #2 immediately below the quarry crossing had Chironomidae percentages that were near the top end of the range of those of the five control stations both seasons. Taxa richness during the 2002 season at Millers Creek station #2 was noticeably lower at 50 than taxa richness at Millers Creek station #1 of 67 and the five control streams which ranged from 64 to 86. However, total EPT taxa at Millers Creek did not fall below the range of EPT taxa at the five control streams during the 2002 season, which ranged from 14 to 18.

During the 2003 sampling season, taxa richness at the Millers Creek #2 quarry crossing was considerably higher at 79 than the previous year at 50. It was comparable to the taxa richness of the downstream Millers Creek station at 78 and three of the control streams, which ranged from 80 to 82. At Prairie Fork, Middle River, and Hillers Creek, taxa richness was notably higher during the 2003 season than 2002 while Whetstone Creek and Bachelor Creek had comparable taxa richness between the two sample seasons. During the 2003 season however, the total EPT taxa at the Millers Creek quarry site of 12 was somewhat below the total EPT taxa of the five control streams and the downstream Millers Creek site, which ranged from 16 to 23.

Table 14
2002 Millers Creek and Local Control Stream Macroinvertebrate Composition

	Millers Cr. #1	Millers Cr. #2	Bachelor Cr.	Middle R.	Whetstone Cr. (1A)	Whetstone Cr. (1B)	Prairie Fk.	Hillers Cr.
Taxa Richness	67	50	79	71	86	78	66	64
EPTT	15	14	15	16	18	16	14	16
% Ephemeroptera	11.2	4.2	25.6	8.5	18.4	21.2	5.1	7.6
% Plecoptera	0.9	4.3	2.9	7.9	2.4	3.9	4.9	1.8
% Trichoptera	0.7	0.6	1.1	0.4	1	0.6	0.3	1.5
Total EPT %	12.8	9.1	29.6	16.8	21.8	25.7	10.3	10.9
% Diptera	76.5	88.5	63.5	77.4	70.5	65.9	86	85.3
% Dominant Families								
Chironomidae	73.9	88	61	76.2	68.8	64.4	82.9	84.5
Baetidae	-	-	-	-	-	-	-	0.9
Caenidae	7.9	3.5	20	4.1	10.8	11.5	2.6	-
Perlodidae	-	0.6	2	6.4	-	-	-	1
Leuctridae	-	0.6	-	-	-	-	-	-
Perlidae	-	2.5	-	-	1.2	2.2	-	-
Nemouridae	-	-	-	-	-	-	2.1	-
Elmidae	-	-	1.8	1.5	1.9	-	-	1.1
Heptageniidae	3	-	4	4	6.7	8.8	2.1	5.9
Hyalellidae	4.8	-	-	-	-	-	-	-
Tubificidae	1.5	-	-	-	-	1.7	-	-
Enchytraeidae	-	-	-	-	-	-	1.2	-

Table 15
 2003 Millers Creek and Local Control Stream Macroinvertebrate Composition

	Millers Cr. #1	Millers Cr. #2	Bachelor Cr.	Middle R.	Whetstone Cr.	Prairie Fk.	Hillers Cr.
Taxa Richness	78	79	80	88	82	80	94
EPTT	16	12	16	22	15	16	23
% Ephemeroptera	30.1	15.2	24.2	20.7	7.5	23.8	14.5
% Plecoptera	1.8	6	7.7	6.7	7.3	4.2	4.1
% Trichoptera	0.8	0.5	0.9	2.2	0.3	0.7	3.4
Total EPT %	32.7	21.7	32.8	29.6	15.1	28.7	22
% Diptera	60.7	67.7	53.2	53.1	72.7	63.9	60
% Dominant Families							
Chironomidae	57.4	62.7	43.9	48.1	63.4	59.8	55.2
Baetidae	-	-	10.1	7.8	-	5.7	-
Heptageniidae	7.3	-	-	5.5	4.4	2.4	6.9
Caenidae	22.3	11.8	13.5	7.2	-	15.7	4.3
Perlidae	1.3	4.7	4	-	4.4	-	-
Nemouridae	-	-	-	-	-	1.5	-
Elmidae	-	2.5	6.2	5.5	-	-	6.9
Ceratopoginidae	2.4	3.9	-	-	4.3	-	-
Tubificidae	-	-	-	-	4.4	-	3.5
Enchytraeidae	-	-	-	-	-	1.5	-

6.0 Discussion

Physicochemical results reveal few definitive trends. Since sampling was conducted only during the spring, seasonal differences were not an issue. The most notable difference was the elevated conductivity levels at both Millers Creek sites during the 2002 season. Turbidity levels were noticeably different between seasons at all sites and are likely a function of relative stream discharge. Millers Creek turbidity levels were higher during the 2003 sampling when stream discharges at both of those sites were higher. Conversely, turbidity levels at the five control streams were higher during the 2002 season when discharges at those locations were higher.

Macroinvertebrate data reveal somewhat of an overall upturn during the 2003 season. Both Millers Creek sites received SCI rankings of “partially sustainable” in 2002 as well as three of the five control streams. The Millers Creek sites ranked “partially sustainable” whether compared with Ozark/Moreau/Loutre reference criteria or criteria derived from the five control streams. However, the total SCI score of each Millers Creek site that year was 12 when compared with the five control streams and 14 when compared with Ozark/Moreau/Loutre reference criteria. Whetstone and Bachelor Creeks were the only two control streams to receive an SCI ranking of “fully sustainable” during 2002.

Both Millers Creek sites, as well as all five control streams, received an SCI ranking of “fully sustainable” in 2003. Total scores for the Millers Creek sites were slightly lower at 16 than the control streams that had scores of 18 or 20.

Another difference in macroinvertebrate communities is the noticeably lower taxa richness at the Millers Creek quarry site during the 2002 season when compared with the 2003 season as well as all other sites during either season. One possible reason for this could be lower long-term discharge during the 2002 season. Rootmat and coarse substrate habitats were minimal at this site in general and lower water levels further reduced the availability of these habitats. In spite of the lower total taxa at the Millers Creek quarry site during 2002, EPT taxa were slightly higher in 2002 than 2003.

At the Millers Creek #2 site in 2002, Chironomidae made up 88% of the total taxa, which was the highest level in this study. However, it did not greatly exceed Chironomidae percentages at the higher end of the control stream range substantially for the same season. Prairie Fork and Hillers Creek had Chironomidae percentages of 82.9 and 84.5, respectively.

There is no apparent trend that explains the upturn in overall macroinvertebrate quality for 2003. Precipitation could have played a role in increased macroinvertebrate quality in 2003. Records indicate slightly higher precipitation levels in 2003 in adjacent Boone County during the months of February and March.

There is no trend indicated by physicochemical data, habitat assessments, or macroinvertebrate communities to show a substantial impairment at the Millers Creek quarry site. The most noticeable trends are between sample seasons, not between Millers Creek site #2 and the other sample stations. There are visible impacts, however, on Millers Creek. At the quarry-crossing

site there are considerable deposits of quarry chat in the substrate that gradually disperse as the stream approaches the downstream site. These deposits at least pose an aesthetic problem, but are beyond the scope of this study.

7.0 Conclusions

The main trend in this study is more of a change between sample seasons (years) than locations. Sustainability rankings at both Millers Creek sites were the same as three of the five control sites in 2002 and the same as all five in 2003. Sustainability rankings and total SCI scores were similar between the two Millers Creek sites within sample seasons.

Based on this study, there can be no conclusion drawn that the Mertens' Quarry is causing a substantial impairment on the macroinvertebrate communities in Millers Creek.

8.0 Recommendations

Because deposition from the quarry continues to be an issue at Millers Creek, continued monitoring is recommended.

It is also recommended that Mertens' Quarry continue to be encouraged to operate within Best Management Practices (**BMPs**) to control the quantity of chat entering the stream.

9.0 Summary

1. The null hypothesis that macroinvertebrate assemblages will not differ substantially between Millers Creek and similar sized reaches of reference streams within the Ozark/Moreau/Loutre EDU is accepted.
2. The null hypothesis that macroinvertebrate assemblages will not differ between longitudinally separate reaches of Millers Creek is accepted.
3. There was no difference in sustainability rankings at Millers Creek sites between comparisons with Ozark/Moreau/Loutre EDU reference biocriteria vs. local control streams and there was no substantial difference in total scores between the different comparisons.

10.0 References

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Missouri Department of Natural Resources. 2003b. Stream Habitat Assessment Project Procedure. MDNR-FSS-032. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 40 pp.

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Appendix A

Proposed Bioassessment Study Plan
Miller's Creek
February 14, 2002

Missouri Department of Natural Resources
Bioassessment Study Plan

Millers Creek, Callaway County

February 14, 2002

Objective

This study will characterize the aquatic macroinvertebrate community in Miller's Creek downstream from a limestone quarry to determine whether the stream is impaired and warrants continued 303(d) listing. Our specific objectives are to determine: 1) whether there is aquatic life impairment immediately downstream of the quarry relative to regional reference streams; and 2) if aquatic life impairment is demonstrated near the quarry, whether recovery of the community downstream of this location, but prior to its entrance into Cedar Creek, is indicated.

Null Hypotheses

- 1) Macroinvertebrate assemblages will not substantially differ between Millers Creek and similar sized reaches of reference streams within the Ozark-Moreau/Loutre Rivers Ecological Drainage Unit (EDU).
- 2) The macroinvertebrate assemblages will not differ between longitudinally separate reaches of Millers Creek.

Background

Millers Creek, in western Callaway County, has been surveyed during low flow conditions by personnel from the Water Pollution Control Program (WPCP). They noted large amounts of limestone in a variety of sizes deposited in the creek downstream of the road crossing on the Merten's Quarry property. This portion of Millers Creek is presently on the 303(d) list. Additionally, WPCP biologists have noted several other quarries where road crossings consisting of crushed limestone lose substantial amounts of material into the streams during high flow events. Our goal to examine the potential impairment to receiving streams in these situations. If impairment is demonstrated, WPCP would have additional leverage to require changes either through Section 401 certification or through permits.

Study Design

General: Two Millers Creek stations will be surveyed. The general locations are as follows: 1) below the main Merton Quarry, Miller Creek crossing just downstream of the Highway J road crossing; and 2) approximately 0.5 to 1 mile downstream of the site describe above. In addition, five local unimpaired or minimally-impaired streams will be surveyed. These include: 1) Bachelor Creek west of the southern terminus of County Rd. 1037 (NW Sec. 34, T49N, R7W); 2) Middle River upstream of the bridge on County Rd. 305 (NE Sec. 5, T45N, R9W); 3) Whetstone Creek in the southeastern portion of the Whetstone Creek Conservation Area (NW Sec. 10, T48N, R7W); 4) Prairie Fork upstream of the bridge on County Rd. 170 (NE Sec. 11 T47N R7W); and 5) Hillers Creek upstream of County Rd. 436 (SE Sec. 33 T46N R10W). These were selected using criteria for the establishment of reference stream conditions and will be used as local reference streams for the purpose of this study. Local references are necessary because the Ozark-Moreau/Loutre Rivers EDU is a transition area between ozark and prairie conditions. Existing regional reference streams may not be appropriate depending upon soil and geological characteristics. Additional regional references are also necessary because Miller Creek is not a perennial stream and wadeable/perennial biological criteria would not be applicable.

Each station will consist of a length approximately 20 times the average stream width, and will contain at least two riffle areas, as outlined in MDNR-FSS-032. In order to assess variability among sampling stations,

stream discharge, habitat assessment and water chemistry will be determined during macroinvertebrate surveys. Sampling will be conducted during the spring of 2002 and 2003 (March 15 through April 15).

Biological Sampling Methods: Macroinvertebrates will be sampled as per the guidelines of the Semi-Quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP). Each of the creeks in this study will be considered “riffle/pool” predominant streams; therefore samples will be collected from flow over coarse substrate, depositional (non-flow) and root-mat habitats. Each macroinvertebrate sample will be a composite of six subsamples within each habitat.

Habitat Sampling Methods: Stream discharge will be measured at each sampling location using a Marsh-McBirney flow meter. Stream habitat assessments will also be conducted within each study area following the guidelines of MDNR-FSS-032.

Water Quality Sampling Methods: Water samples from all sampled stations will be analyzed at the ESP laboratory for ammonia, nitrogen as $\text{NO}_2 + \text{NO}_3$, total Kjeldahl nitrogen, total phosphorus, chloride and turbidity. Field measurements will include pH, conductivity, temperature and dissolved oxygen.

Laboratory Methods: All samples of macroinvertebrates will be processed and identified as per MDNR-FSS-209, Taxonomic Levels for Macroinvertebrate Identification. Turbidity samples will be analyzed at the MDNR biological laboratory

Data Recording and Analyses: Macroinvertebrate data will be entered in a Microsoft Access database in accordance with MDNR-WQMS-214, Quality Control Procedures for Data Processing. Data analysis is automated within the Access database. Four standard metrics are calculated according to the SMSBPP: Total Taxa (TT); Ephemeroptera, Plecoptera, Trichoptera Taxa (EPTT); Biotic Index (BI); and the Shannon Index (SI) will be calculated for each reach. Additional metrics, such as Quantitative Similarity Index for Taxa (QSI-T), or Percent Scrapers (PS) may be employed to discern differences in taxa between control and impacted stations.

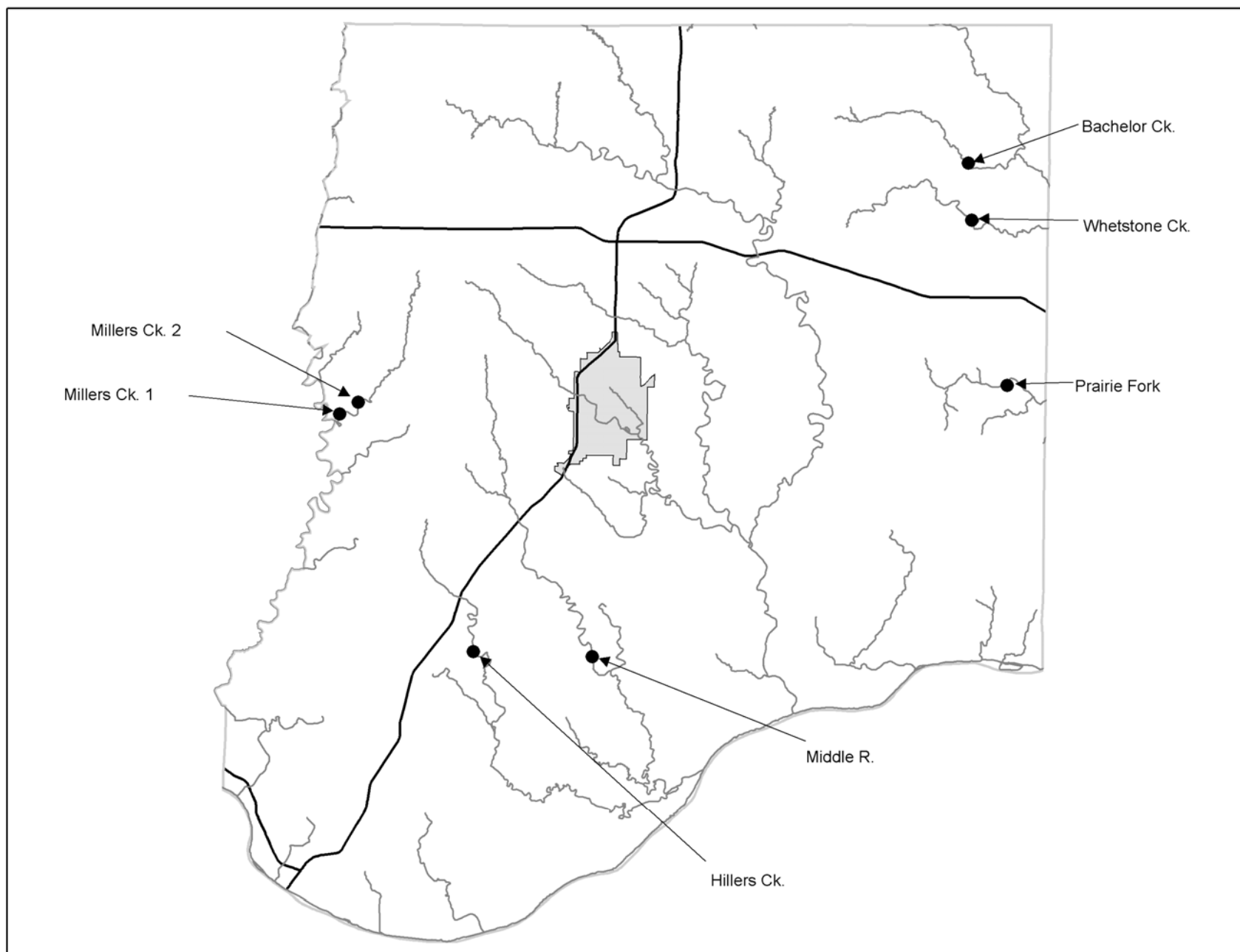
Macroinvertebrate data will be analyzed in two specific ways. First, a longitudinal comparison between the two reaches on Millers Creek will be performed. Secondly, the data from the Millers Creek sites will be compared to biological criteria from five local unimpaired, or minimally impaired, streams within the same watershed size classification. The data from these streams will be used to calculate 25th percentiles for the four metrics of the SMSBPP.

Data Reporting: Results of the study will be summarized and interpreted in report format.

Quality Control: As stated in the various MDNR Project Procedures and Standard Operating Procedures.

Attachments

Map of all sampling stations in this study



Appendix B

Maps

Millers Creek
Ozark/Moreau/Loutre EDU

&

Five Control Streams including

Bachelor Creek

Middle River

Whetstone Creek

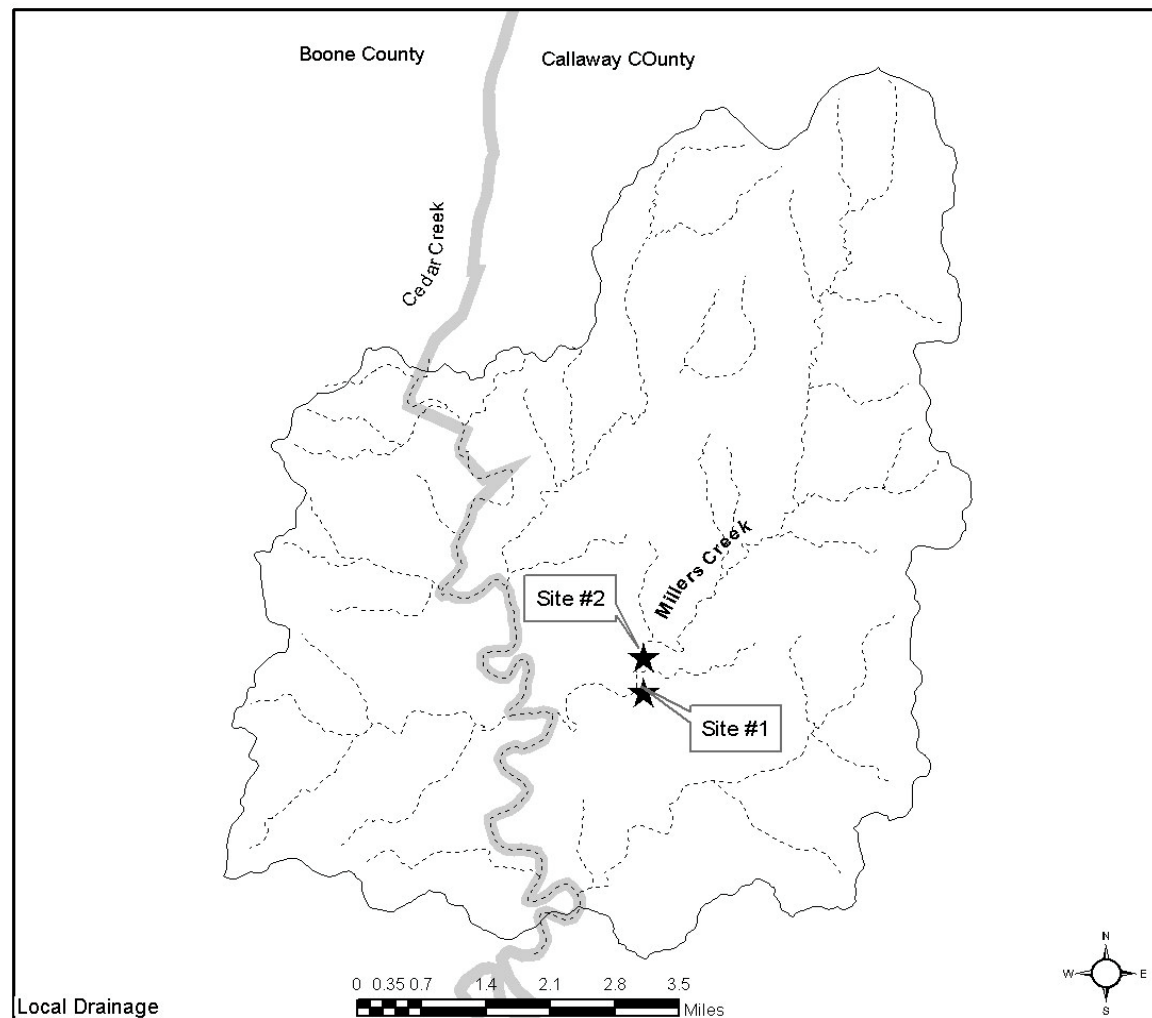
Prairie Fork

&

Hillers Creek

Ozark/Moreau/Loutre EDU

Millers Creek



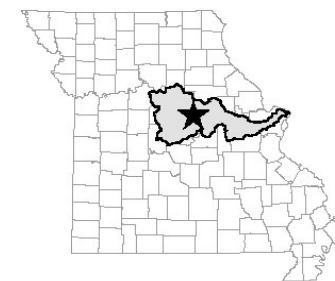
Local Drainage

- ★ Sampling Location
- County Boundary
- Local Drainage
- Stream/River

Local Drainage and Biologic Sampling Site Location

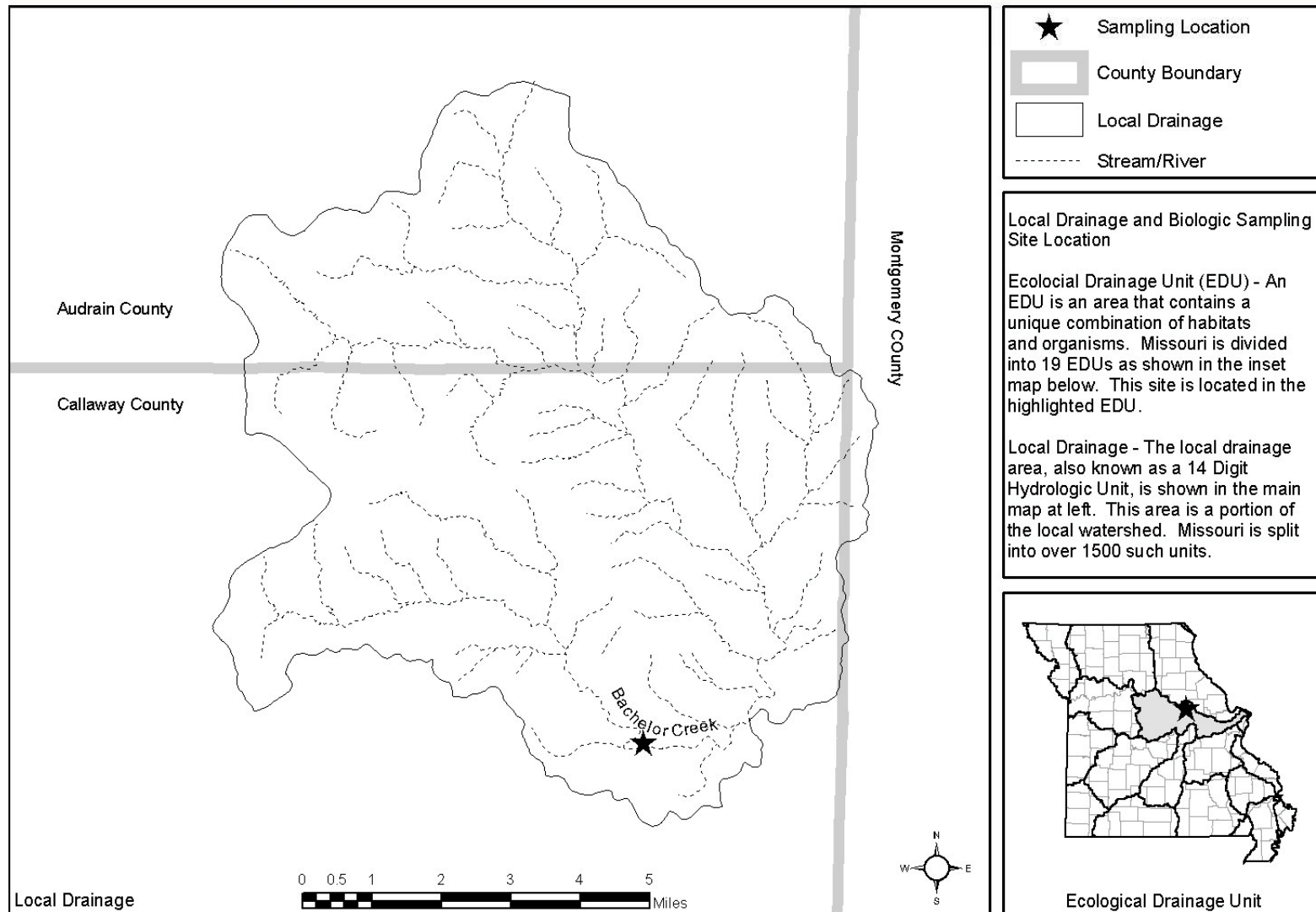
Ecological Drainage Unit (EDU) - An EDU is an area that contains a unique combination of habitats and organisms. Missouri is divided into 19 EDUs as shown in the inset map below. This site is located in the highlighted EDU.

Local Drainage - The local drainage area, also known as a 14 Digit Hydrologic Unit, is shown in the main map at left. This area is a portion of the local watershed. Missouri is split into over 1500 such units.

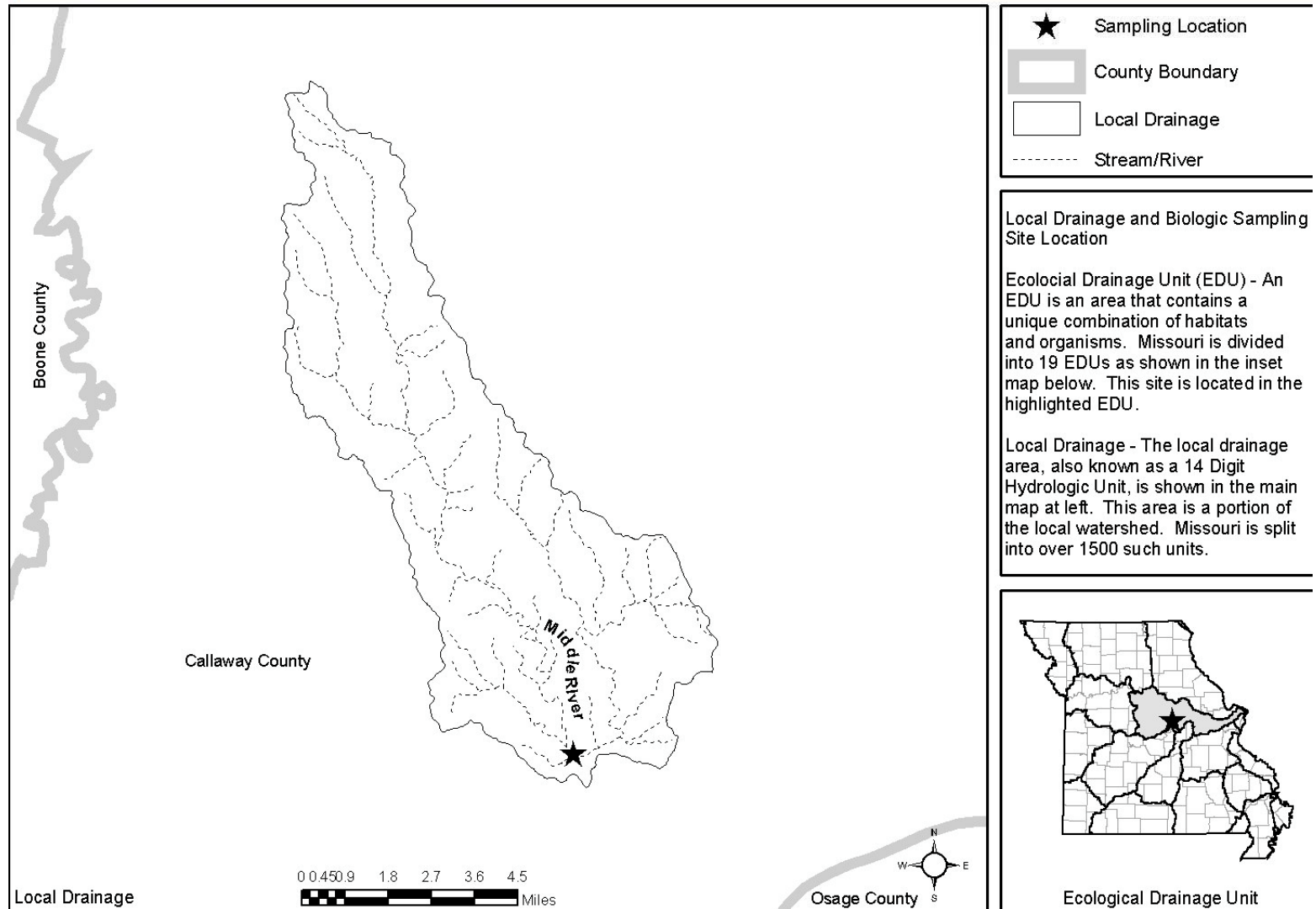


Ecological Drainage Unit

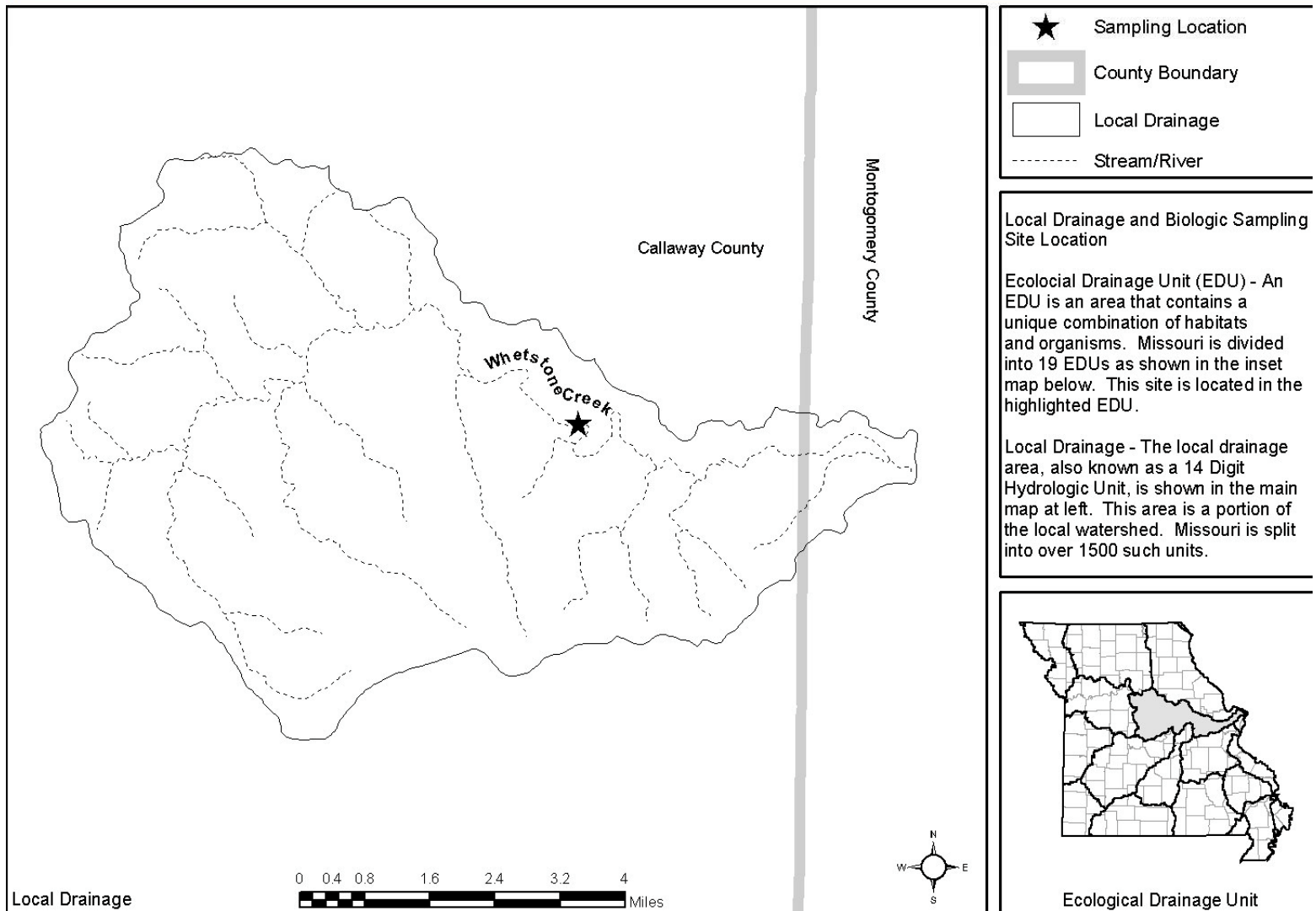
Bachelor Creek (Millers Creek Study)



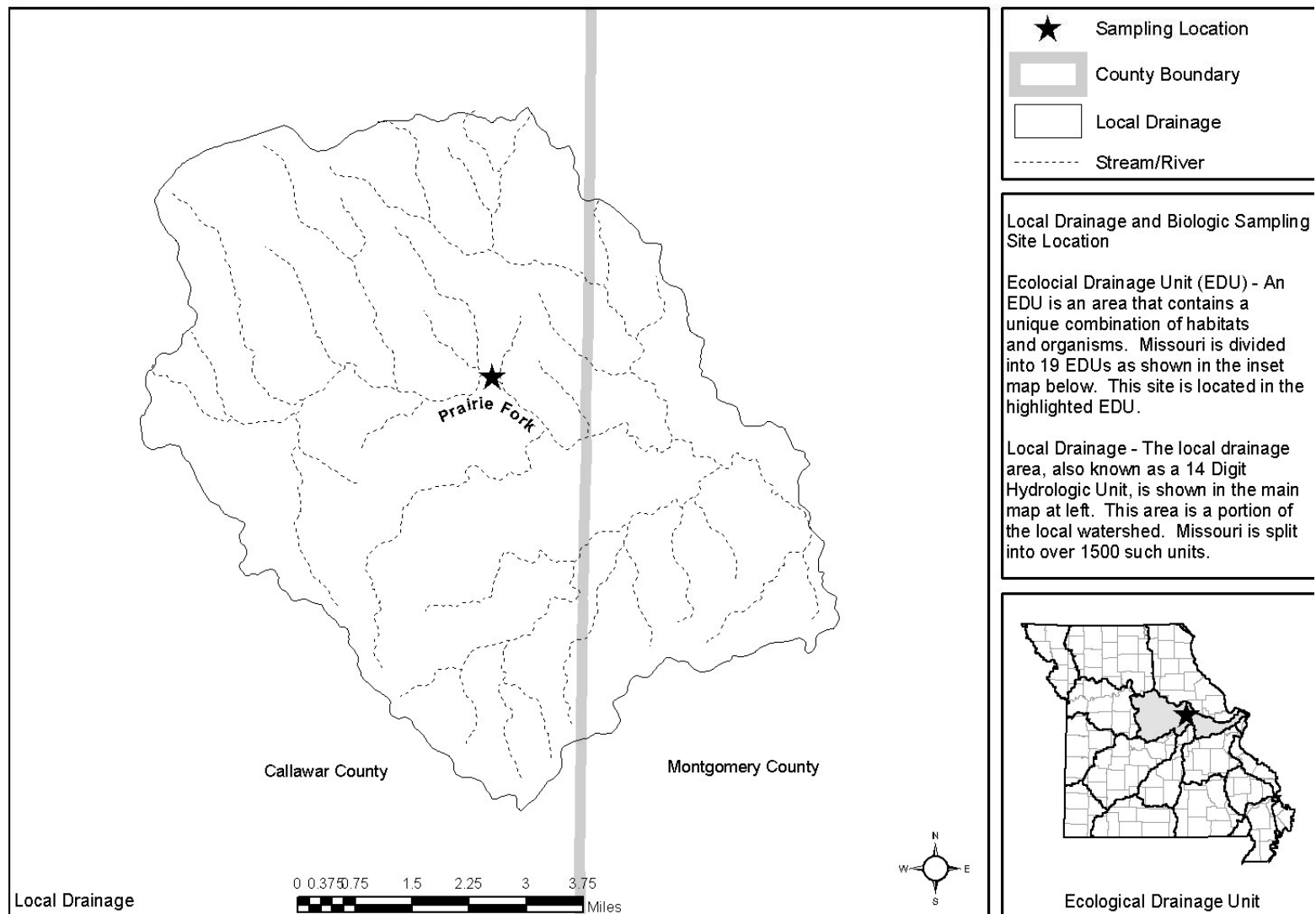
Middle River (Millers Creek Study)



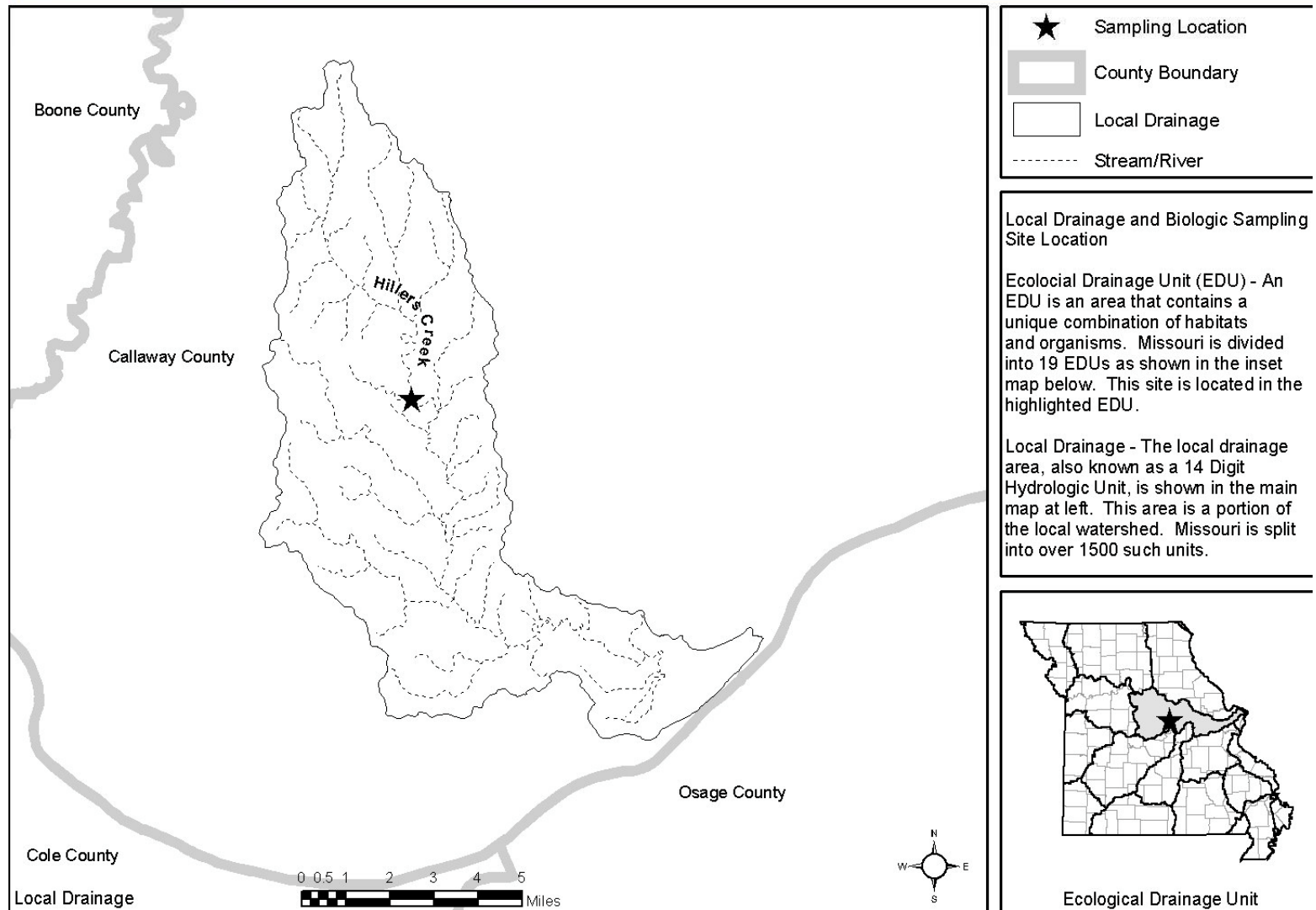
Whetstone Creek (Millers Creek Study)



Prairie Fork (Millers Creek Study)



Hillers Creek (Millers Creek Study)



Appendix C

Macroinvertebrate Bench Sheets

Millers Creek Site #1
April 2002, Sample #0218061 (1 of 2)

TAXA	CS	NF	RM	Family
Branchiobdellida			3	
Tubificidae		4		Tubificidae
Aulodrilus		8		Tubificidae
Limnodrilus hoffmeisteri	2	3		Tubificidae
Limnodrilus		2		Tubificidae
Caecidotea	6	1		Asellidae
Hyaella azteca			59	Hyaellidae
Orconectes punctimanus		-99	-99	Cambaridae
Baetidae			1	Baetidae
Acerpenna	1			Baetidae
Stenacron	6	3		Heptageniidae
Stenonema femoratum	13	11	4	Heptageniidae
Caenis latipennis	9	57	31	Caenidae
Hexagenia		1		Ephemeridae
Enallagma			9	Coenagrionidae
Nasiaeschna			1	Aeshnidae
Epitheca (Epicordulia)			1	Libellulidae
Libellula		1	-99	Libellulidae
Leuctridae	2			Leuctridae
Amphinemura	5			Nemouridae
Perlesta	5			Perlidae
Wormaldia	3			Philopotamidae
Chimarra	1			Philopotamidae
Polycentropus			-99	Polycentropodidae
Rhyacophila	3			Rhyacophilidae
Pycnopsyche			1	Limnephilidae
Triaenodes			1	Leptoceridae
Tropisternus			1	Hydrophilidae
Helichus			2	Dryopidae
Dubiraphia			6	Elmidae
Stenelmis	5		2	Elmidae
Tipula	-99		-99	Tipulidae
Ceratopogoninae		11		Ceratopogonidae
Simulium	6			Simuliidae
Prosimulium	4			Simuliidae
Ablabesmyia		6	3	Chironomidae
Larsia		1	2	Chironomidae
Procladius		2		Chironomidae
Cricotopus bicinctus			1	Chironomidae
Corynoneura	4	4	4	Chironomidae
Cricotopus/Orthocladius	445	36	94	Chironomidae
Eukiefferiella brevicar	4			Chironomidae

Millers Creek Site #1
April 2002, Sample #0218061 (2 of 2)

TAXA	CS	NF	RM	Family
Parametriocnemus	3			Chironomidae
Rheocricotopus	1			Chironomidae
Hydrobaenus	9	117	29	Chironomidae
Tvetenia	1			Chironomidae
Chironomus		1		Chironomidae
Cryptochironomus		1		Chironomidae
Dicrotendipes	1	1	11	Chironomidae
Microtendipes		9	3	Chironomidae
Paratendipes		11		Chironomidae
Polypedilum		1		Chironomidae
Polypedilum illinoense	2		3	Chironomidae
Polypedilum scalaenum	5	10	1	Chironomidae
Stictochironomus		12	1	Chironomidae
Cladotanytarsus	4	2		Chironomidae
Paratanytarsus		1	1	Chironomidae
Rheotanytarsus	1			Chironomidae
Tanytarsus	2	12	13	Chironomidae
Clinocera	8			Empididae
Thienemannimyia grp.	18		6	Chironomidae
Natarsia		1		Chironomidae
Diptera	1	2		
Acarina		2		
Physella		1	5	Physidae
Ferrissia			1	Ancylidae
Sphaerium	2			Sphaeriidae

CS = Coarse Substrate Habitat

NF = Non-flow Habitat

RM = Rootmat Habitat

-99 = Present

Millers Creek Site #2
April 2, 2002, Sample #0218060 (1 of 2)

TAXA	CS	NF	RM	Family
Caecidotea (Blind &	1	7		Asellidae
Hyaella azteca			3	Hyaellidae
Stenacron		3		Heptageniidae
Stenonema femoratum	1	5		Heptageniidae
Caenis latipennis	5	44	2	Caenidae
Leptophlebia		1		Leptophlebiidae
Libellula			1	Libellulidae
Allocapnia	2	1		Capniidae
Leuctridae	10			Leuctridae
Amphinemura	3			Nemouridae
Perlesta	35		1	Perlidae
Isoperla	10			Perlodidae
Trichocorixa			1	Corixidae
Wormaldia	3			Philopotamidae
Rhyacophila	5		-99	Rhyacophilidae
Ptilostomis			-99	Phryganeidae
Ironoquia			1	Limnephilidae
Pycnopsyche			-99	Limnephilidae
Peltodytes			2	Halplidae
Oreodytes		2		Dytiscidae
Scirtes		1		Scirtidae
Stenelmis	8			Elmidae
Ceratopogoninae		2		Ceratopogonidae
Simulium	4			Simuliidae
Prosimulium	1			Simuliidae
Ablabesmyia	1	14	2	Chironomidae
Larsia	2			Chironomidae
Nilotanytus	1			Chironomidae
Cricotopus trifascia		1		Chironomidae
Cricotopus bicinctus	2		2	Chironomidae
Corynoneura	1		1	Chironomidae
Cricotopus/Orthocladius	634	69	266	Chironomidae
Eukiefferiella brevicar	6			Chironomidae
Parametriocnemus			1	Chironomidae
Hydrobaenus	18	118	48	Chironomidae
Tvetenia	3			Chironomidae
Cryptochironomus	2	1		Chironomidae
Dicrotendipes		2		Chironomidae
Paratendipes		3		Chironomidae
Polypedilum halterale grp		1		Chironomidae
Polypedilum illinoense	4	1	2	Chironomidae
Polypedilum scalaenum	7	19	1	Chironomidae

Millers Creek Site #2
 April 2, **2002**, Sample #0218060 (2 of 2)

TAXA	CS	NF	RM	Family
Stictochironomus		7		Chironomidae
Cladotanytarsus	1	2		Chironomidae
Tanytarsus	1	14	2	Chironomidae
Tabanus	-99			Tabanidae
Thienemannimyia grp.	6	1		Chironomidae
Acarina		2		
Fossaria			1	Lymnaeidae
Physella			4	Physidae

CS = Coarse Substrate Habitat
 NF = Non-flow Habitat
 RM = Rootmat Habitat
 -99 = Present

Bachelor Creek
March 28, 2002, Sample #0218059 (1 of 2)

TAXA	CS	NF	RM	Family
Gordiidae	-99			Gordiidae
Branchiobdellida	1		6	
Tubificidae	3			Tubificidae
Limnodrilus		1		Tubificidae
Enchytraeidae	1			Enchytraeidae
Hyaella azteca		2	10	Hyaellidae
Orconectes punctimanus	2		3	Cambaridae
Orconectes virilis			-99	Cambaridae
Acerpenna	9			Baetidae
Centropilum	1		5	Baetidae
Stenacron	3	3		Heptageniidae
Stenonema femoratum	15	18	8	Heptageniidae
Caenis latipennis	28	86	116	Caenidae
Hexagenia limbata		2	1	Ephemeridae
Argia		2		Coenagrionidae
Enallagma			2	Coenagrionidae
Progomphus obscurus		-99	1	Gomphidae
Libellulidae		1		Libellulidae
Libellula			2	Libellulidae
Allocapnia	1			Capniidae
Amphinemura	4			Nemouridae
Perlesta	5			Perlidae
Hydroperla crosbyi	1			Perlodidae
Isoperla	23			Perlodidae
Microvelia			1	Veliidae
Chimarra	6			Philopotamidae
Cheumatopsyche	3		1	Hydropsychidae
Rhyacophila	2			Rhyacophilidae
Hydroptilidae			1	Hydroptilidae
Peltodytes		1	4	Haliplidae
Helichus lithophilus			1	Dryopidae
Dubiraphia			2	Elmidae
Stenelmis	11	5	3	Elmidae
Tipula	-99			Tipulidae
Gonomyia		3		Tipulidae
Hexatoma	1			Tipulidae
Ceratopogoninae	2	1	1	Ceratopogonidae
Simulium	7			Simuliidae
Prosimulium	9			Simuliidae
Ablabesmyia		6	6	Chironomidae
Larsia		1		Chironomidae
Nilotanytus	2			Chironomidae

Bachelor Creek
March 28, 2002, Sample #0218059 (2 of 2)

TAXA	CS	NF	RM	Family
Cricotopus trifascia	3			Chironomidae
Corynoneura	22	13	7	Chironomidae
Cricotopus/Orthocladius	294	29	30	Chironomidae
Eukiefferiella	3			Chironomidae
Eukiefferiella brevicar	18		3	Chironomidae
Orthocladius	7			Chironomidae
Nanocladius			3	Chironomidae
Parametriocnemus	1			Chironomidae
Hydrobaenus	22	25		Chironomidae
Thienemanniella	2			Chironomidae
Tvetenia	12			Chironomidae
Bryophaenocladius		1	1	Chironomidae
Cryptochironomus	1	2	1	Chironomidae
Dicrotendipes	3	4	3	Chironomidae
Microtendipes		3	2	Chironomidae
Paratendipes	1	9		Chironomidae
Phaenopsectra			1	Chironomidae
Polypedilum halterale grp	1	1		Chironomidae
Polypedilum convictum		1		Chironomidae
Polypedilum fallax grp			1	Chironomidae
Polypedilum illinoense		1		Chironomidae
Polypedilum scalaenum	5	3		Chironomidae
Stictochironomus	2	9		Chironomidae
Cladotanytarsus	4	9		Chironomidae
Paratanytarsus			12	Chironomidae
Rheotanytarsus	21	2		Chironomidae
Tanytarsus	16	43	3	Chironomidae
Tabanus	-99			Tabanidae
Clinocera	5			Empididae
Zavreliomyia		1	2	Chironomidae
Thienemannimyia grp.	10	2	7	Chironomidae
Labrundinia		2	2	Chironomidae
Acarina		1		
Lymnaeidae	2			Lymnaeidae
Physella	1		3	Physidae
Ancylidae	1	2		Ancylidae
Sphaerium	1			Sphaeriidae

CS = Coarse Substrate Habitat

NF = Non-flow Habitat

RM = Rootmat Habitat

-99 = Present

Middle River
March 27, 2002, Sample #0218056 (1 of 2)

TAXA	CS	NF	RM	Family
Tubificidae	1	5		Tubificidae
Enchytraeidae	2	9		Enchytraeidae
Caecidotea	2		3	Asellidae
Hyaella azteca			10	Hyaellidae
Crangonyx	-99	2	1	Crangonyctidae
Baetidae	1			Baetidae
Centropilum			3	Baetidae
Stenacron		2	1	Heptageniidae
Stenonema femoratum	24	21	3	Heptageniidae
Caenis latipennis	9	9	34	Caenidae
Paraleptophlebia	1			Leptophlebiidae
Calopteryx			1	Calopterygidae
Argia		1		Coenagrionidae
Enallagma		1	7	Coenagrionidae
Basiaeschna janata		-99		Aeshnidae
Allocapnia	2			Capniidae
Amphinemura	7			Nemouridae
Chloroperlidae	4			Chloroperlidae
Perlesta	5			Perlidae
Hydroperla crosbyi	-99			Perlodidae
Isoperla	82			Perlodidae
Philopotamidae	1			Philopotamidae
Cheumatopsyche	2		1	Hydropsychidae
Pycnopsyche			1	Limnephilidae
Triaenodes			1	Leptoceridae
Peltodytes			4	Halilidae
Hydroporus		1		Dytiscidae
Dubiraphia		1	7	Elmidae
Stenelmis	12			Elmidae
Tipula	-99	-99		Tipulidae
Gonomyia	1			Tipulidae
Hexatoma	1		-99	Tipulidae
Ceratopogoninae		5	2	Ceratopogonidae
Simulium	4			Simuliidae
Ablabesmyia		5	3	Chironomidae
Procladius		1		Chironomidae
Cricotopus trifascia	4			Chironomidae
Corynoneura	10	13	10	Chironomidae
Cricotopus/Orthocladius	369	61	82	Chironomidae
Eukiefferiella brevicar	8			Chironomidae
Orthocladius	3			Chironomidae
Parametriochnemus	13	2		Chironomidae

Middle River
March 27, **2002**, Sample #0218056 (2 of 2)

TAXA	CS	NF	RM	Family
Rheocricotopus	3			Chironomidae
Pseudosmittia		1		Chironomidae
Hydrobaenus	37	97	52	Chironomidae
Thienemanniella	6	1		Chironomidae
Chironomus		1		Chironomidae
Cryptochironomus	2	5		Chironomidae
Dicrotendipes		4	2	Chironomidae
Demicryptochironomus		1		Chironomidae
Paratendipes	2	17		Chironomidae
Phaenopsectra			1	Chironomidae
Polypedilum halterale grp		1		Chironomidae
Polypedilum convictum	11			Chironomidae
Polypedilum illinoense			3	Chironomidae
Polypedilum scalaenum	3	14	1	Chironomidae
Stictochironomus		4		Chironomidae
Pseudochironomus			1	Chironomidae
Cladotanytarsus	3	18	2	Chironomidae
Paratanytarsus		2	9	Chironomidae
Rheotanytarsus	1			Chironomidae
Stempellinella		3		Chironomidae
Tanytarsus	2	37	10	Chironomidae
Tabanus	-99		-99	Tabanidae
Clinocera	1			Empididae
undescribed Empididae		1		Empididae
Diamesa	1			Chironomidae
Sympotthastia	6	1		Chironomidae
Thienemannimyia grp.	6	5	3	Chironomidae
Labrundinia			1	Chironomidae
Acarina			1	

CS = Coarse Substrate Habitat

NF = Non-flow Habitat

RM = Rootmat Habitat

-99 = Present

Whetstone Creek 1A
March 28, 2002, Sample #0218057 (1 of 3)

TAXA	CS	NF	RM	Family
Tubificidae	1	5		Tubificidae
Limnodrilus cervix		1		Tubificidae
Limnodrilus hoffmeisteri		6		Tubificidae
Enchytraeidae	2			Enchytraeidae
Caecidotea		1	3	Asellidae
Hyaella azteca			7	Hyaellidae
Crangonyx	-99		11	Crangonyctidae
Stygobromus		1		Crangonyctidae
Orconectes	-99			Cambaridae
Orconectes punctimanus		-99		Cambaridae
Orconectes virilis			-99	Cambaridae
Acerpenna	6			Baetidae
Centroptilum			3	Baetidae
Isonychia	1			Isonychiidae
Stenacron		2		Heptageniidae
Stenonema femoratum	68	6	3	Heptageniidae
Caenis latipennis	29	31	67	Caenidae
Hexagenia limbata		-99		Ephemeridae
Argia			2	Coenagrionidae
Enallagma			2	Coenagrionidae
Libellula			2	Libellulidae
Amphinemura	2			Nemouridae
Perlesta	13			Perlidae
Perlinella drymo		-99	2	Perlidae
Hydropetra crosbyi	-99			Perlodidae
Isoperla	12			Perlodidae
Belostoma			-99	Belostomatidae
Cheumatopsyche	5		1	Hydropsychidae
Rhyacophila	2			Rhyacophilidae
Hydroptilidae	1			Hydroptilidae
Pycnopsyche			-99	Limnephilidae
Triaenodes			2	Leptoceridae
Oecetis		1		Leptoceridae
Dineutus			1	Gyrinidae
Peltodytes		1	2	Halipidae
Hydroporus			1	Dytiscidae
Helichus basalis			2	Dryopidae
Helichus lithophilus			1	Dryopidae
Scirtes			2	Scirtidae
Dubiraphia	1	1	6	Elmidae
Stenelmis	12	3		Elmidae
Gonomyia		1		Tipulidae

Whetstone Creek 1A
March 28, 2002, Sample #0218057 (2 of 3)

TAXA	CS	NF	RM	Family
Hexatoma	-99			Tipulidae
Limonia	1			Tipulidae
Ceratopogoninae	1	4		Ceratopogonidae
Simulium	1			Simuliidae
Prosimulium	6			Simuliidae
Ablabesmyia	2	4	1	Chironomidae
Procladius		2		Chironomidae
Cricotopus trifascia	2			Chironomidae
Cricotopus bicinctus	5		1	Chironomidae
Corynoneura	5	2	8	Chironomidae
Cricotopus/Orthocladius	379	11	47	Chironomidae
Eukiefferiella	2			Chironomidae
Eukiefferiella brevicar	16			Chironomidae
Orthocladius	6			Chironomidae
Parametriochnemus	10			Chironomidae
Rheocricotopus	1			Chironomidae
Hydrobaenus	5	12	8	Chironomidae
Chironomus	1	8		Chironomidae
Cryptochironomus	2	7		Chironomidae
Dicrotendipes	3	7	11	Chironomidae
Glyptotendipes	2		1	Chironomidae
Demicryptochironomus	1			Chironomidae
Microtendipes	5	2		Chironomidae
Paratendipes	1	49	4	Chironomidae
Phaenopsectra	1	2	2	Chironomidae
Polypedilum halterale grp		6		Chironomidae
Polypedilum convictum	4			Chironomidae
Polypedilum fallax grp			1	Chironomidae
Polypedilum scalaenum	4	4		Chironomidae
Stictochironomus		16		Chironomidae
Pseudochironomus		1		Chironomidae
Cladotanytarsus	2	19		Chironomidae
Paratanytarsus	1		28	Chironomidae
Stempellinella	1	2		Chironomidae
Tanytarsus	14	35	13	Chironomidae
Dixella			1	Dixidae
Tabanus	-99			Tabanidae

Whetstone Creek **1A**
 March 28, **2002**, Sample #0218057 (3 of 3)

TAXA	CS	NF	RM	Family
Clinocera	5			Empididae
Diamesa	1			Chironomidae
Sympotthastia	2			Chironomidae
Thienemannimyia grp.	9	1	2	Chironomidae
Acarina		7		
Physella			3	Physidae
Sphaerium	-99			Sphaeriidae

CS = Coarse Substrate Habitat

NF = Non-flow Habitat

RM = Rootmat Habitat

-99 = Present

Whetstone Creek **1B**
March 28, **2002**, Sample #0218058 (1 of 2)

TAXA	CS	NF	RM	Family
Gordiidae	1			Gordiidae
Tubificidae	1	10	1	Tubificidae
Limnodrilus cervix		3		Tubificidae
Limnodrilus hoffmeisteri		4	1	Tubificidae
Enchytraeidae	7		1	Enchytraeidae
Caecidotea		1	4	Asellidae
Hyaella azteca			6	Hyaellidae
Crangonyx	2	2	11	Crangonyctidae
Acerpenna	7			Baetidae
Centropilum			3	Baetidae
Stenonema femoratum	92	8	3	Heptageniidae
Caenis latipennis	35	41	58	Caenidae
Hexagenia limbata		-99		Ephemeridae
Enallagma			3	Coenagrionidae
Libellula			1	Libellulidae
Amphinemura	4	1		Nemouridae
Chloroperlidae	1			Chloroperlidae
Perlesta	25			Perlidae
Perlina drymo			1	Perlidae
Hydroperla crosbyi	1			Perlodidae
Isoperla	12		1	Perlodidae
Belostoma			-99	Belostomatidae
Chimarra	1			Philopotamidae
Cheumatopsyche	4			Hydropsychidae
Rhyacophila			-99	Rhyacophilidae
Pycnopsyche			1	Limnephilidae
Triaenodes			1	Leptoceridae
Peltodytes			5	Halplidae
Oreodytes			1	Dytiscidae
Hydroporus		1	1	Dytiscidae
Helichus basalis			3	Dryopidae
Scirtes			1	Scirtidae
Dubiraphia		1	5	Elmidae
Stenelmis	9	1		Elmidae
Tipula	-99			Tipulidae
Gonomyia			1	Tipulidae
Hexatoma	1	-99		Tipulidae
Ceratopogoninae	1	3		Ceratopogonidae
Simulium	1			Simuliidae
Prosimulium	3	1		Simuliidae
Ablabesmyia		6	6	Chironomidae
Larsia	1	1	1	Chironomidae

Whetstone Creek **1B**
 March 28, **2002**, Sample #0218058 (2 of 2)

TAXA	CS	NF	RM	Family
Cricotopus trifascia	2			Chironomidae
Corynoneura	5	3	6	Chironomidae
Cricotopus/Orthocladius	315	5	69	Chironomidae
Eukiefferiella brevicar	12			Chironomidae
Orthocladius	4			Chironomidae
Parakiefferiella	1			Chironomidae
Parametriocnemus		1		Chironomidae
Rheocricotopus	2		1	Chironomidae
Hydrobaenus	8	2	22	Chironomidae
Thienemanniella			1	Chironomidae
Tvetenia	1			Chironomidae
Chironomus	1	5		Chironomidae
Cryptochironomus	1	6		Chironomidae
Dicrotendipes	1	11	31	Chironomidae
Glyptotendipes			9	Chironomidae
Microtendipes	2	3	5	Chironomidae
Paratendipes	1	27		Chironomidae
Phaenopsectra			2	Chironomidae
Polypedilum halterale grp		10		Chironomidae
Polypedilum convictum	1			Chironomidae
Polypedilum scalaenum	2	8		Chironomidae
Stictochironomus		22		Chironomidae
Cladotanytarsus	2	29		Chironomidae
Paratanytarsus		1	32	Chironomidae
Rheotanytarsus	1			Chironomidae
Stempellinella	1	1		Chironomidae
Tanytarsus	2	20	16	Chironomidae
Dixella			1	Dixidae
Tabanus	-99	1		Tabanidae
Clinocera	5			Empididae
Thienemannimyia grp.	11	2	4	Chironomidae
Acarina		1	1	
Fossaria			1	Lymnaeidae
Physella	1		2	Physidae
Sphaerium	1	1		Sphaeriidae

CS = Coarse Substrate Habitat
 NF = Non-flow Habitat
 RM = Rootmat Habitat
 -99 = Present

Prairie Fork
March 27, 2002, Sample #0218055 (1 of 2)

TAXA	CS	NF	RM	Family
Gordiidae	1			Gordiidae
Tubificidae		1		Tubificidae
Enchytraeidae	10	3	2	Enchytraeidae
Hyaella azteca			1	Hyaellidae
Crangonyx	1	1	4	Crangonyctidae
Baetidae			1	Baetidae
Centropilum			3	Baetidae
Stenonema femoratum	23	3	1	Heptageniidae
Caenis latipennis	7	17	8	Caenidae
Enallagma			1	Coenagrionidae
Macromia			3	Libellulidae
Allocapnia	1			Capniidae
Zealeuctra			1	Leuctridae
Amphinemura	26		1	Nemouridae
Chloroperlidae	4	1		Chloroperlidae
Perlesta	13		1	Perlidae
Hydroperla crosbyi			-99	Perlodidae
Isoperla	13			Perlodidae
Wormaldia	2			Philopotamidae
Cheumatopsyche	1			Hydropsychidae
Rhyacophila	1			Rhyacophilidae
Peltodytes		2	4	Halipidae
Scirtes			2	Scirtidae
Dubiraphia			1	Elmidae
Stenelmis	1	2		Elmidae
Tipula	1			Tipulidae
Gonomyia		1		Tipulidae
Hexatoma	9			Tipulidae
Chaoborus	1			Chaoboridae
Ceratopogoninae		6	1	Ceratopogonidae
Simulium	4			Simuliidae
Prosimulium	7			Simuliidae
Ablabesmyia		1	1	Chironomidae
Cricotopus trifascia	13		9	Chironomidae
Cricotopus bicinctus		1		Chironomidae
Corynoneura	9	10	18	Chironomidae
Cricotopus/Orthocladius	397	78	205	Chironomidae
Eukiefferiella brevicar	12			Chironomidae
Orthocladius	9	3	6	Chironomidae
Parametriocnemus	1	1		Chironomidae
Rheocricotopus	1		1	Chironomidae
Hydrobaenus	15	63	4	Chironomidae

Prairie Fork
March 27, **2002**, Sample #0218055 (1 of 2)

TAXA	CS	NF	RM	Family
Thienemanniella	1		4	Chironomidae
Tvetenia	1			Chironomidae
Cryptochironomus		3		Chironomidae
Dicrotendipes		4	1	Chironomidae
Microtendipes	1			Chironomidae
Paratendipes		39		Chironomidae
Polypedilum halterale grp		1		Chironomidae
Polypedilum illinoense			1	Chironomidae
Polypedilum scalaenum	2	15		Chironomidae
Stictochironomus		4		Chironomidae
Pseudochironomus	1			Chironomidae
Cladotanytarsus	4	15	1	Chironomidae
Paratanytarsus			4	Chironomidae
Tanytarsus	2	30	3	Chironomidae
Tabanus		2	1	Tabanidae
Clinocera	4	1		Empididae
Ephydriidae		1		Ephydriidae
Diamesa	1			Chironomidae
Sympotthastia	12	2	4	Chironomidae
Djalmabatista		1		Chironomidae
Thienemannimyia grp.		2	2	Chironomidae
Acarina		1		
Physella			1	Physidae
Ancylidae		1		Ancylidae

CS = Coarse Substrate Habitat

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-99 = Present

Hillers Creek
March 26, 2002, Sample #0218054 (1 of 2)

TAXA	CS	NF	RM	Family
Tubificidae		7		Tubificidae
Branchiura sowerbyi		1		Tubificidae
Limnodrilus cervix		1		Tubificidae
Enchytraeidae	3	1		Enchytraeidae
Hyaella azteca		1	4	Hyaellidae
Crangonyx	2	1		Crangonyctidae
Centropilum			11	Baetidae
Stenacron		1		Heptageniidae
Stenonema femoratum	15	48	7	Heptageniidae
Caenis latipennis	1	1	2	Caenidae
Leptophlebia			4	Leptophlebiidae
Paraleptophlebia			1	Leptophlebiidae
Hexagenia limbata		1		Ephemeridae
Allocaenia	1			Capniidae
Leuctridae	1			Leuctridae
Chloroperlidae	2			Chloroperlidae
Perlesta	3			Perlidae
Perlinella drymo			3	Perlidae
Isoperla	12			Perlodidae
Wormaldia	1			Philopotamidae
Rhyacophila	8			Rhyacophilidae
Pycnopsyche		1	8	Limnephilidae
Peltodytes		2	1	Halplidae
Hydroporus			1	Dytiscidae
Paracymus		1		Hydrophilidae
Stenelmis	7	4	3	Elmidae
Hexatoma	1			Tipulidae
Ceratopogoninae		1		Ceratopogonidae
Simulium	3			Simuliidae
Prosimulium	1			Simuliidae
Ablabesmyia	1	4	1	Chironomidae
Nilotanytus	1			Chironomidae
Procladius		2		Chironomidae
Corynoneura	21	4	19	Chironomidae
Cricotopus/Orthocladius	311	38	134	Chironomidae
Eukiefferiella	3			Chironomidae
Eukiefferiella brevicar	6			Chironomidae
Orthocladius	1			Chironomidae
Parametriochnemus	14	1		Chironomidae
Rheocricotopus			1	Chironomidae
Hydrobaenus	213	33	54	Chironomidae
Thienemanniella	2		3	Chironomidae

Hillers Creek
March 26, 2002, Sample #0218054 (2 of 2)

TAXA	CS	NF	RM	Family
Tvetenia	9			Chironomidae
Endochironomus			1	Chironomidae
Chironomus		4		Chironomidae
Cryptochironomus		2		Chironomidae
Dicrotendipes	1	2	8	Chironomidae
Glyptotendipes			6	Chironomidae
Microtendipes		6		Chironomidae
Paratendipes		23	1	Chironomidae
Phaenopsectra		1		Chironomidae
Polypedilum convictum	3			Chironomidae
Polypedilum illinoense			2	Chironomidae
Polypedilum scalaenum	16	6		Chironomidae
Stictochironomus		23		Chironomidae
Cladotanytarsus	1	3		Chironomidae
Paratanytarsus		3		Chironomidae
Tanytarsus	1	15	4	Chironomidae
Tabanus	1			Tabanidae
Clinocera	2			Empididae
Thienemannimyia grp.	3	2	1	Chironomidae
Diptera		1		
Physella			2	Physidae
Pisidium	2			Sphaeriidae

CS = Coarse Substrate Habitat
 NF = Non-flow Habitat
 RM = Rootmat Habitat
 -99 = Present

Millers Creek #1
April 10, 2003, Sample #0318695 (1 of 2)

TAXA	CS	NF	RM	Family
Branchiobdellida		1		
Lumbricidae	2			Lumbricidae
Tubificidae	2	5		Tubificidae
Ilyodrilus templetoni		1		Tubificidae
Limnodrilus hoffmeisteri	1	5		Tubificidae
Limnodrilus		1		Tubificidae
Enchytraeidae		1		Enchytraeidae
Lirceus		1	1	Asellidae
Hyaella azteca			9	Hyaellidae
Orconectes virilis		1	1	Cambaridae
Acerpenna	1			Baetidae
Centroptilum		2		Baetidae
Stenacron	36	6		Heptageniidae
Stenonema femoratum	50	10	2	Heptageniidae
Caenis latipennis	76	116	126	Caenidae
Leptophlebiidae			3	Leptophlebiidae
Paraleptophlebia	1			Leptophlebiidae
Argia	1			Coenagrionidae
Enallagma			1	Coenagrionidae
Gomphus			1	Gomphidae
Progomphus obscurus			1	Gomphidae
Amphinemura	5		2	Nemouridae
Perlesta	18		1	Perlidae
Microvelia			1	Veliidae
Polycentropus	2			Polycentropodidae
Cheumatopsyche	1			Hydropsychidae
Rhyacophila	3			Rhyacophilidae
Ironoquia			-99	Limnephilidae
Pycnopsyche			1	Limnephilidae
Helicopsyche			1	Helicopsychidae
Triaenodes			4	Leptoceridae
Peltodytes		2		Haliplidae
Dytiscidae			1	Dytiscidae
Hydroporus			1	Dytiscidae
Berosus		1		Hydrophilidae
Tropisternus			-99	Hydrophilidae
Helichus basalis			4	Dryopidae
Scirtes			4	Scirtidae
Dubiraphia			1	Elmidae
Stenelmis	3	8		Elmidae
Tipula	1			Tipulidae
Hexatoma	2			Tipulidae

Millers Creek #1
April 10, 2003, Sample #0318695 (2 of 2)

TAXA	CS	NF	RM	Family
Chaoborus	1			Chaoboridae
Ceratopogonidae	15	20		Ceratopogonidae
Ablabesmyia	13	53	15	Chironomidae
Larsia	3	1		Chironomidae
Nilotanypus	8	2		Chironomidae
Procladius		1		Chironomidae
Cricotopus bicinctus		1	1	Chironomidae
Corynoneura	1	1		Chironomidae
Cricotopus/Orthocladius	245	38	68	Chironomidae
Eukiefferiella	1	1		Chironomidae
Parametrioctenus	1			Chironomidae
Hydrobaenus	6	41	12	Chironomidae
Cryptochironomus	6	9	1	Chironomidae
Dicrotendipes	2	7	7	Chironomidae
Microtendipes	1	2		Chironomidae
Paratendipes	1	1		Chironomidae
Polypedilum halterale grp		1		Chironomidae
Polypedilum convictum	5	1		Chironomidae
Polypedilum illinoense	5	3	8	Chironomidae
Polypedilum scalaenum	80	37	1	Chironomidae
Stictochironomus		3		Chironomidae
Cladotanytarsus	7	15	2	Chironomidae
Paratanytarsus			6	Chironomidae
Rheotanytarsus	2		2	Chironomidae
Tanytarsus	7	20	15	Chironomidae
Tabanus	-99	1		Tabanidae
Hemerodromia	1			Empididae
Clinocera	2	1		Empididae
undescribed Empididae		1		Empididae
Thienemannimyia grp.	36	3	9	Chironomidae
Diptera	2			
Acarina	2	15	2	
Physella	-99	3	6	Physidae
Ancylidae		1		Ancylidae
Sphaerium	1			Sphaeriidae
Corbicula			-99	Corbiculidae

CS = Coarse Substrate Habitat

NF = Non-flow Habitat

RM = Rootmat Habitat

-99 = Present

Millers Creek #2
April 10, 2003, Sample #0318694 (1 of 2)

TAXA	CS	NF	RM	Family
Gordiidae	1			Gordiidae
Tubificidae	2	2	8	Tubificidae
Aulodrilus		2		Tubificidae
Limnodrilus hoffmeisteri	3	4		Tubificidae
Limnodrilus		2		Tubificidae
Enchytraeidae			5	Enchytraeidae
Caecidotea		-99		Asellidae
Caecidotea (Blind &	1			Asellidae
Hyaella azteca		1	8	Hyaellidae
Crangonyx		2	23	Crangonyctidae
Acentrella	2			Baetidae
Acerpenna	7		1	Baetidae
Nixe	1		1	Heptageniidae
Stenacron		1		Heptageniidae
Stenonema femoratum	14	9	2	Heptageniidae
Caenis latipennis	46	44	62	Caenidae
Leptophlebiidae		1	4	Leptophlebiidae
Argia			1	Coenagrionidae
Enallagma			1	Coenagrionidae
Basiaeschna janata			-99	Aeshnidae
Dromogomphus		-99		Gomphidae
Libellulidae			3	Libellulidae
Amphinemura	16			Nemouridae
Perlesta	59		2	Perlidae
Rhyacophila	-99		-99	Rhyacophilidae
Ironoquia			2	Limnephilidae
Triaenodes			5	Leptoceridae
Peltodytes		3	3	Haliplidae
Agabus			2	Dytiscidae
Hydroporus		1	4	Dytiscidae
Helichus lithophilus			2	Dryopidae
Dubiraphia			2	Elmidae
Stenelmis	28	1	2	Elmidae
Tipula	1		-99	Tipulidae
Gonomyia		1		Tipulidae
Hexatoma	1			Tipulidae
Ceratopogoninae	3	46	2	Ceratopogonidae
Simulium	1			Simuliidae
Ablabesmyia		23	6	Chironomidae
Nilotanytus	3		1	Chironomidae
Procladius		2		Chironomidae
Cricotopus/Orthocladius	259	28	109	Chironomidae

Millers Creek #2
April 10, 2003, Sample #0318694 (2 of 2)

TAXA	CS	NF	RM	Family
Diplocladius	1			Chironomidae
Eukiefferiella	1			Chironomidae
Parametrioctenus	2			Chironomidae
Hydrobaenus	3	65	11	Chironomidae
Tvetenia	2			Chironomidae
Chironomus		7		Chironomidae
Cryptochironomus		2		Chironomidae
Dicrotendipes	3	2	1	Chironomidae
Cryptotendipes		1		Chironomidae
Paracladopelma		3		Chironomidae
Nilothauma		1		Chironomidae
Paratendipes	3	4	1	Chironomidae
Phaenopsectra	1		1	Chironomidae
Polypedilum halterale grp		3		Chironomidae
Polypedilum		1		Chironomidae
Polypedilum convictum	23	2		Chironomidae
Polypedilum illinoense	9	1	25	Chironomidae
Polypedilum scalaenum	45	21		Chironomidae
Stictochironomus		5		Chironomidae
Cladotanytarsus		13	1	Chironomidae
Paratanytarsus	2		6	Chironomidae
Rheotanytarsus			1	Chironomidae
Tanytarsus	13	21	34	Chironomidae
Chrysops			1	Tabanidae
Tabanus	-99			Tabanidae
Hemerodromia	1			Empididae
Clinocera	2			Empididae
undescribed Empididae	1			Empididae
Zavreliomyia			5	Chironomidae
Thienemannimyia grp.	19		7	Chironomidae
Natarsia		1		Chironomidae
Diptera		3	1	
Acarina		8		
Fossaria	1			Lymnaeidae
Physella	1	1	5	Physidae
Menetus		1		Planorbidae
Sphaeriidae	1			Sphaeriidae

CS = Coarse Substrate Habitat
 NF = Non-flow Habitat
 RM = Rootmat Habitat
 -99 = Present

Bachelor Creek
April 9, 2003, Sample #0318693 (1 of 2)

TAXA	CS	NF	RM	Family
Gordiidae	-99			Gordiidae
Branchiobdellida			1	
Tubificidae	2		2	Tubificidae
Branchiura sowerbyi		6		Tubificidae
Limnodrilus hoffmeisteri		4		Tubificidae
Enchytraeidae	20		3	Enchytraeidae
Hyaella azteca			10	Hyaellidae
Orconectes			-99	Cambaridae
Orconectes virilis			-99	Cambaridae
Acentrella	118		1	Baetidae
Centropilum			2	Baetidae
Nixe	2	2		Heptageniidae
Stenonema femoratum	3			Heptageniidae
Caenis latipennis	22	10	130	Caenidae
Leptophlebia			1	Leptophlebiidae
Argia			1	Coenagrionidae
Enallagma			1	Coenagrionidae
Basiaeschna janata			-99	Aeshnidae
Libellulidae			6	Libellulidae
Amphinemura	38			Nemouridae
Perlesta	47		2	Perlidae
Isoperla	6			Perlodidae
Wormaldia	4			Philopotamidae
Rhyacophila	1			Rhyacophilidae
Ptilostomis			-99	Phryganeidae
Ironoquia			2	Limnephilidae
Pycnopsyche		-99	1	Limnephilidae
Helicopsyche	1		1	Helicopsychidae
Oecetis		1		Leptoceridae
Oreodytes		1	2	Dytiscidae
Desmopachria			1	Dytiscidae
Berosus		-99	1	Hydrophilidae
Helichus lithophilus	1		3	Dryopidae
Scirtes			3	Scirtidae
Dubiraphia			6	Elmidae
Stenelmis	67		2	Elmidae
Tipula	3		1	Tipulidae
Gonomyia	2	1	2	Tipulidae
Hexatoma	12		-99	Tipulidae
Ormosia		3		Tipulidae
Pseudolimnophila			1	Tipulidae
Chaoborus		1		Chaoboridae

Bachelor Creek
April 9, 2003, Sample #0318693 (2 of 2)

TAXA	CS	NF	RM	Family
Ceratopogoninae	5	26	2	Ceratopogonidae
Simulium	6			Simuliidae
Prosimulium	7			Simuliidae
Ablabesmyia		2	4	Chironomidae
Larsia	3	1	4	Chironomidae
Procladius		1		Chironomidae
Cricotopus/Orthocladius	183	6	28	Chironomidae
Eukiefferiella	8	1		Chironomidae
Orthocladius	11	1		Chironomidae
Parakiefferiella		1		Chironomidae
Parametrioctonus	3			Chironomidae
Paraphaenocladius			1	Chironomidae
Rheocricotopus			1	Chironomidae
Smittia		1		Chironomidae
Hydrobaenus	18	123	45	Chironomidae
Tvetenia	5			Chironomidae
Chironomus		12		Chironomidae
Dicrotendipes	1		1	Chironomidae
Paracladopelma		1		Chironomidae
Nilothauma			1	Chironomidae
Paratendipes	2	1		Chironomidae
Phaenopsectra			3	Chironomidae
Polypedilum scalaenum	6	1	1	Chironomidae
Stictochironomus		5		Chironomidae
Cladotanytarsus	9	11		Chironomidae
Paratanytarsus			1	Chironomidae
Stempellinella		1		Chironomidae
Tanytarsus		4	4	Chironomidae
Tabanus	1			Tabanidae
Clinocera	6	1		Empididae
Sympotthastia	2			Chironomidae
Thienemannimyia grp.	3		5	Chironomidae
Diptera	3	27	2	
Acarina		6	4	
Physella			5	Physidae
Ancylidae		1	2	Ancylidae
Ferrissia			1	Ancylidae
Sphaeriidae	1		2	Sphaeriidae

CS = Coarse Substrate Habitat
NF = Non-flow Habitat

RM = Rootmat
-99 = Present

Middle River
April 3, 2003, Sample #0318690 (1 of 2)

TAXA	CS	NF	RM	Family
Gordiidae	1			Gordiidae
Tubificidae	2	2	8	Tubificidae
Aulodrilus		2		Tubificidae
Limnodrilus hoffmeisteri	3	4		Tubificidae
Limnodrilus		2		Tubificidae
Enchytraeidae			5	Enchytraeidae
Caecidotea		-99		Asellidae
Caecidotea (Blind &	1			Asellidae
Hyaella azteca		1	8	Hyaellidae
Crangonyx		2	23	Crangonyctidae
Acentrella	2			Baetidae
Acerpenna	7		1	Baetidae
Nixe	1		1	Heptageniidae
Stenacron		1		Heptageniidae
Stenonema femoratum	14	9	2	Heptageniidae
Caenis latipennis	46	44	62	Caenidae
Leptophlebiidae		1	4	Leptophlebiidae
Argia			1	Coenagrionidae
Enallagma			1	Coenagrionidae
Basiaeschna janata			-99	Aeshnidae
Dromogomphus		-99		Gomphidae
Libellulidae			3	Libellulidae
Amphinemura	16			Nemouridae
Perlesta	59		2	Perlidae
Rhyacophila	-99		-99	Rhyacophilidae
Ironoquia			2	Limnephilidae
Triaenodes			5	Leptoceridae
Peltodytes		3	3	Haliplidae
Agabus			2	Dytiscidae
Hydroporus		1	4	Dytiscidae
Helichus lithophilus			2	Dryopidae
Dubiraphia			2	Elmidae
Stenelmis	28	1	2	Elmidae
Tipula	1		-99	Tipulidae
Gonomyia		1		Tipulidae
Hexatoma	1			Tipulidae
Ceratopogoninae	3	46	2	Ceratopogonidae
Simulium	1			Simuliidae
Ablabesmyia		23	6	Chironomidae
Nilotanytus	3		1	Chironomidae
Procladius		2		Chironomidae
Cricotopus/Orthocladius	259	28	109	Chironomidae

Middle River
April 3, 2003, Sample #0318690 (2 of 2)

TAXA	CS	NF	RM	Family
Diplocladius	1			Chironomidae
Eukiefferiella	1			Chironomidae
Parametriochnemus	2			Chironomidae
Hydrobaenus	3	65	11	Chironomidae
Tvetenia	2			Chironomidae
Chironomus		7		Chironomidae
Cryptochironomus		2		Chironomidae
Dicrotendipes	3	2	1	Chironomidae
Cryptotendipes		1		Chironomidae
Paracladopelma		3		Chironomidae
Nilothauma		1		Chironomidae
Paratendipes	3	4	1	Chironomidae
Phaenopsectra	1		1	Chironomidae
Polypedilum halterale		3		Chironomidae
Polypedilum		1		Chironomidae
Polypedilum convictum	23	2		Chironomidae
Polypedilum illinoense	9	1	25	Chironomidae
Polypedilum scalaenum	45	21		Chironomidae
Stictochironomus		5		Chironomidae
Cladotanytarsus		13	1	Chironomidae
Paratanytarsus	2		6	Chironomidae
Rheotanytarsus			1	Chironomidae
Tanytarsus	13	21	34	Chironomidae
Chrysops			1	Tabanidae
Tabanus	-99			Tabanidae
Hemerodromia	1			Empididae
Clinocera	2			Empididae
undescribed Empididae	1			Empididae
Zavreliomyia			5	Chironomidae
Thienemannimyia grp.	19		7	Chironomidae
Natarsia		1		Chironomidae
Diptera		3	1	
Acarina		8		
Fossaria	1			Lymnaeidae
Physella	1	1	5	Physidae
Menetus		1		Planorbidae
Sphaeriidae	1			Sphaeriidae

CS = Coarse Substrate Habitat

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RM = Rootmat Habitat

-99 = Present

Whetstone Creek
April 9, 2003, Sample #0318692 (1 of 2)

TAXA	CS	NF	RM	Family
Planariidae	1			Planariidae
Gordiidae	1			Gordiidae
Tubificidae		21	1	Tubificidae
Branchiura sowerbyi		1		Tubificidae
Limnodrilus hoffmeisteri		21	1	Tubificidae
Limnodrilus		6		Tubificidae
Enchytraeidae	2	4	2	Enchytraeidae
Lumbriculidae		1		Lumbriculidae
Caecidotea (Blind &		1		Asellidae
Hyaella azteca			3	Hyaellidae
Crangonyx	1	6	1	Crangonyctidae
Acentrella	2			Baetidae
Heptageniidae	16	1		Heptageniidae
Stenacron		1		Heptageniidae
Stenonema femoratum	20	8	4	Heptageniidae
Caenis latipennis	14	3	15	Caenidae
Hexagenia limbata		2		Ephemeridae
Enallagma			2	Coenagrionidae
Basiaeschna janata			1	Aeshnidae
Gomphus		1		Gomphidae
Hagenius brevistylus		1		Gomphidae
Somatochlora			1	Libellulidae
Amphinemura	7			Nemouridae
Chloroperlidae	1			Chloroperlidae
Perlesta	48			Perlidae
Perlinella drymo	1	-99	1	Perlidae
Hydroperla crosbyi	1			Perlodidae
Isoperla	25			Perlodidae
Wormaldia	1			Philopotamidae
Cernotina		3		Polycentropodidae
Pycnopsyche			-99	Limnephilidae
Hydroporus			1	Dytiscidae
Berosus		1	-99	Hydrophilidae
Helichus lithophilus	3			Dryopidae
Dubiraphia			2	Elmidae
Stenelmis	23	1	1	Elmidae
Hexatoma	4	5		Tipulidae
Ormosia	2	1		Tipulidae
Chaoborus		1		Chaoboridae
Ceratopogoninae		25	24	Ceratopogonidae
Simulium	12			Simuliidae
Prosimulium	6			Simuliidae

Whetstone Creek
April 9, 2003, Sample #0318692 (2 of 2)

TAXA	CS	NF	RM	Family
Ablabesmyia		24	10	Chironomidae
Larsia	1			Chironomidae
Procladius		1	1	Chironomidae
Cricotopus/Orthocladius	213	14	25	Chironomidae
Eukiefferiella	10			Chironomidae
Orthocladius	23			Chironomidae
Nanocladius		1	1	Chironomidae
Rheocricotopus	19		2	Chironomidae
Hydrobaenus	20	30	80	Chironomidae
Tvetenia	6	1		Chironomidae
Krenosmittia	1			Chironomidae
Endochironomus		1	1	Chironomidae
Chironomus		2	17	Chironomidae
Cryptochironomus		5	1	Chironomidae
Dicrotendipes	1	6	7	Chironomidae
Glyptotendipes			1	Chironomidae
Paracladopelma		1		Chironomidae
Demicryptochironomus	1	1		Chironomidae
Microtendipes		1	1	Chironomidae
Paratendipes	1	4	7	Chironomidae
Phaenopsectra			1	Chironomidae
Polypedilum halterale		9		Chironomidae
Polypedilum convictum	1			Chironomidae
Polypedilum scalaenum		7	1	Chironomidae
Stictochironomus		47	1	Chironomidae
Cladotanytarsus	6	17	2	Chironomidae
Paratanytarsus			1	Chironomidae
Stempellinella		17	4	Chironomidae
Tanytarsus	4	14	39	Chironomidae
Tabanus	3	3	1	Tabanidae
Clinocera	1			Empididae
Zavrelimyia			2	Chironomidae
Diamesa	1			Chironomidae
Sympotthastia	1			Chironomidae
Thienemannimyia grp.	2		1	Chironomidae
Natarsia		1		Chironomidae
Diptera	2	16		
Acarina		21		
Ancylidae	1			Ancylidae
Sphaeriidae	1			Sphaeriidae

CS = Coarse Substrate Habitat
NF = Non-flow Habitat

RM = Rootmat
-99 = Present

Prairie Fork
April 3, 2003, Sample #0318691 (1 of 2)

TAXA	CS	NF	RM	Family
Tubificidae		2		Tubificidae
Limnodrilus		1		Tubificidae
Enchytraeidae	1	17	1	Enchytraeidae
Lumbriculidae	1	1		Lumbriculidae
Hyaella azteca			4	Hyaellidae
Crangonyx	2	3	6	Crangonyctidae
Acentrella	69		1	Baetidae
Centroptilum		1		Baetidae
Heptageniidae	4		1	Heptageniidae
Stenonema femoratum	14	7	4	Heptageniidae
Caenis latipennis	32	74	89	Caenidae
Calopteryx			3	Calopterygidae
Enallagma			2	Coenagrionidae
Basiaeschna janata			1	Aeshnidae
Dromogomphus		3		Gomphidae
Libellulidae		1	3	Libellulidae
Allocaenia	1			Capniidae
Amphinemura	19			Nemouridae
Chloroperlidae	9	1		Chloroperlidae
Perlesta	17		1	Perlidae
Hydroperla crosbyi	2			Perlodidae
Isoperla	3			Perlodidae
Hydrometra			1	Hydrometridae
Cheumatopsyche	1			Hydropsychidae
Hydroptila	5			Hydroptilidae
Ochrotrichia			1	Hydroptilidae
Ironoquia			1	Limnephilidae
Pycnopsyche			1	Limnephilidae
Cybister	2		1	Dytiscidae
Berosus		3	2	Hydrophilidae
Psephenus herricki	1			Psephenidae
Helichus lithophilus			2	Dryopidae
Scirtes			1	Scirtidae
Dubiraphia	1			Elmidae
Stenelmis	4	1	1	Elmidae
Gonomyia		3		Tipulidae
Hexatoma	5	1		Tipulidae
Ormosia	2	1		Tipulidae
Pilaria			1	Tipulidae
Ceratopogoninae	4	5	3	Ceratopogonidae
Simulium	4			Simuliidae
Prosimulium	2			Simuliidae

Prairie Fork
April 3, 2003, Sample #0318691 (2 of 2)

TAXA	CS	NF	RM	Family
Ablabesmyia		14	5	Chironomidae
Corynoneura		1	1	Chironomidae
Cricotopus/Orthocladius	323	19	118	Chironomidae
Eukiefferiella	26		1	Chironomidae
Nanocladius			1	Chironomidae
Parametriocnemus	4			Chironomidae
Paraphaenocladius			1	Chironomidae
Rheocricotopus	4		5	Chironomidae
Hydrobaenus	18	23	7	Chironomidae
Thienemanniella	1		1	Chironomidae
Tvetenia	3			Chironomidae
Chironomus		3		Chironomidae
Dicrotendipes	3	7	11	Chironomidae
Paracladopelma		1		Chironomidae
Microtendipes		1		Chironomidae
Paratendipes		34	2	Chironomidae
Phaenopsectra	1		2	Chironomidae
Polypedilum halterale		1		Chironomidae
Polypedilum convictum			1	Chironomidae
Polypedilum illinoense	1		4	Chironomidae
Polypedilum scalaenum	2	9	1	Chironomidae
Stictochironomus		5		Chironomidae
Cladotanytarsus	5	28	1	Chironomidae
Paratanytarsus	1		12	Chironomidae
Tanytarsus	2	8	12	Chironomidae
Dixella			1	Dixidae
Tabanus	4			Tabanidae
Dolichopodidae		2		Dolichopodidae
Clinocera	4			Empididae
undescribed Empididae	2			Empididae
Zavreliomyia			2	Chironomidae
Sympotthastia	2			Chironomidae
Thienemannimyia grp.	1		4	Chironomidae
Diptera		4	3	
Acarina		4	3	
Physella		1	3	Physidae
Ferrissia		6		Ancylidae
Sphaerium		1		Sphaeriidae

CS = Coarse Substrate Habitat
NF = Non-flow Habitat

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-99 = Present

Hillers Creek
April 2, 2003, Sample #0318689 (1 of 3)

TAXA	CS	NF	RM	Family
Branchiobdellida			1	
Tubificidae		27	1	Tubificidae
Branchiura sowerbyi		10		Tubificidae
Limnodrilus hoffmeisteri	1	1	5	Tubificidae
Enchytraeidae	3	7		Enchytraeidae
Lumbriculidae			1	Lumbriculidae
Caecidotea			2	Asellidae
Hyaella azteca		1	22	Hyaellidae
Crangonyx		1	2	Crangonyctidae
Stygobromus		1		Crangonyctidae
Orconectes		1		Cambaridae
Orconectes virilis			1	Cambaridae
Ameletidae			1	Ameletidae
Acentrella	20			Baetidae
Acerpenna	1			Baetidae
Centroptilum			13	Baetidae
Heptageniidae	7	1	1	Heptageniidae
Stenacron	1	1		Heptageniidae
Stenonema femoratum	33	33	12	Heptageniidae
Ephemerellidae		1		Ephemerellidae
Caenis latipennis	3	19	34	Caenidae
Leptophlebiidae		2	4	Leptophlebiidae
Argia	1		1	Coenagrionidae
Enallagma			2	Coenagrionidae
Basiaeschna janata			-99	Aeshnidae
Libellulidae			1	Libellulidae
Somatochlora			1	Libellulidae
Allocapnia			3	Capniidae
Amphinemura	16			Nemouridae
Chloroperlidae	2			Chloroperlidae
Perlesta	19	2	3	Perlidae
Perlinella drymo			-99	Perlidae
Isoperla	8			Perlodidae
Microvelia			1	Veliidae
Wormaldia	11			Philopotamidae
Cernotina			1	Polycentropodidae
Rhyacophila	-99			Rhyacophilidae
Hydroptila	17		1	Hydroptilidae
Isonychia			3	Limnephilidae
Pycnopsyche		-99	9	Limnephilidae
Helicopsyche	2			Helicopsychidae
Hydroporus			1	Dytiscidae

Hillers Creek
April 2, 2003, Sample #0318689 (2 of 3)

TAXA	CS	NF	RM	Family
Ectopria nervosa	1			Psephenidae
Helichus			2	Dryopidae
Scirtes			3	Scirtidae
Dubiraphia			5	Elmidae
Stenelmis	75	5	4	Elmidae
Tipula	-99		-99	Tipulidae
Hexatoma	3			Tipulidae
Dasyheleinae	1			Ceratopogonidae
Ceratopogoninae	9	16	4	Ceratopogonidae
Simulium	4		1	Simuliidae
Prosimulium	5			Simuliidae
Ablabesmyia	1	30	35	Chironomidae
Larsia	2	1		Chironomidae
Procladius		2		Chironomidae
Corynoneura			1	Chironomidae
Cricotopus/Orthocladius	250	5	26	Chironomidae
Eukiefferiella	29			Chironomidae
Parametriocnemus	14			Chironomidae
Rheocricotopus	2		3	Chironomidae
Hydrobaenus	26	31	12	Chironomidae
Tvetenia	2			Chironomidae
Endochironomus			3	Chironomidae
Chironomus		3		Chironomidae
Cryptochironomus	1	1		Chironomidae
Dicrotendipes	1	5	8	Chironomidae
Glyptotendipes			4	Chironomidae
Cryptotendipes		1		Chironomidae
Microtendipes	1	2	1	Chironomidae
Paratendipes	3	27	13	Chironomidae
Phaenopsectra			1	Chironomidae
Polypedilum convictum	13		1	Chironomidae
Polypedilum illinoense		1	13	Chironomidae
Polypedilum scalaenum	25	11	2	Chironomidae
Stictochironomus		7		Chironomidae
Cladotanytarsus	8	4	1	Chironomidae
Micropsectra	1			Chironomidae
Paratanytarsus		2	13	Chironomidae
Stempellinella		9	2	Chironomidae
Tanytarsus	5	12	12	Chironomidae

Hillers Creek
April 2, **2003**, Sample #0318689 (3 of 3)

TAXA	CS	NF	RM	Family
Chrysops			1	Tabanidae
Tabanus	1		-99	Tabanidae
Hemerodromia	1			Empididae
Clinocera	9	1		Empididae
undescribed Empididae	1			Empididae
Zavrelimyia	1	3	1	Chironomidae
Thienemannimyia grp.	8	3	4	Chironomidae
Natarsia		1		Chironomidae
Diptera	1	3		
Acarina	2	6	5	
Physella		2	11	Physidae
Ferrissia	3	1	1	Ancylidae
Sphaeriidae	1	2	4	Sphaeriidae

CS = Coarse Substrate Habitat

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